Labor Saving Number

MARCH, 1924

Railway Engineering and Maintenance

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Today

RAIL ANTI-CREEPERS

May not have been necessary in the olden days—but TODAY they are used throughout the world

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Nut Locks

When the track walker tightens up a Hy-Crome Nut Lock he is immediately conscious of its more uniform power of resistance, its even tension. This first impression later becomes a positive conviction, for time exacts but little toll from the reactive forces of Hy-Crome—the nut lock that keeps rail joints permanently tight.

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Booth 108½

RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisers, Page 54 Classified Index to Advertisers, Pages 52 and 54

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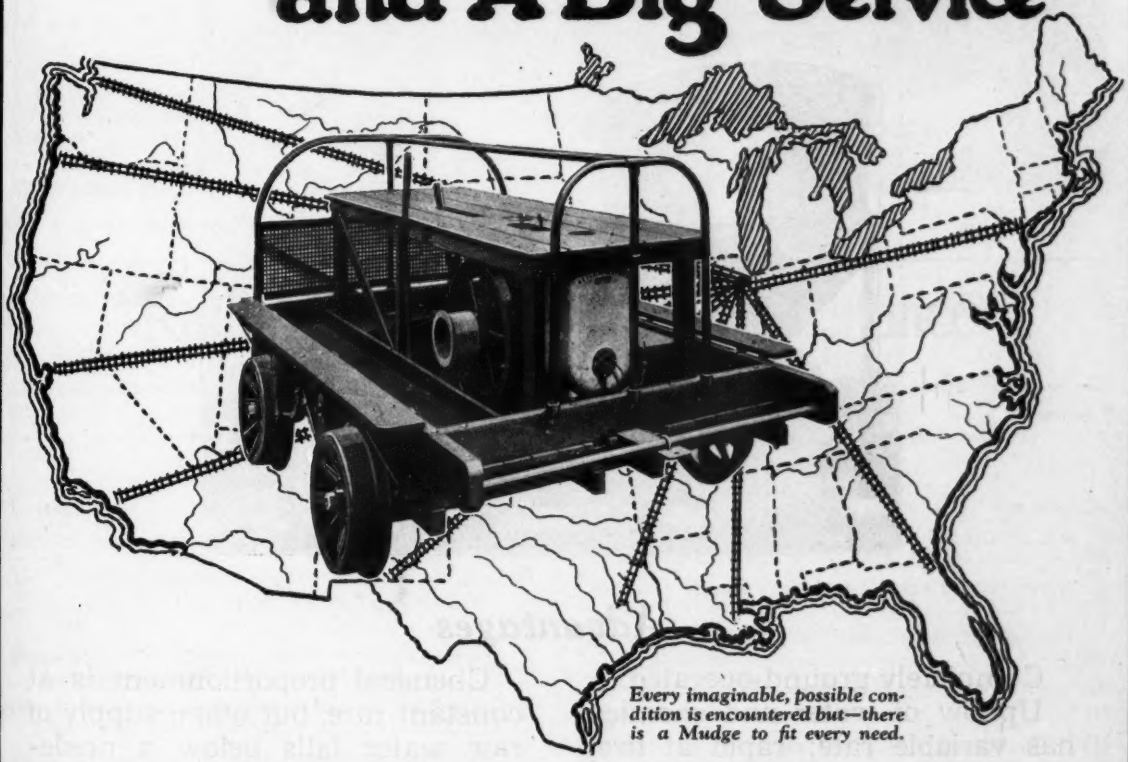

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With Mudge Motor Cars in successful operation on railroads over the whole country—standard on many roads—our knowledge of conditions is nation wide. Our ability to build cars to fit those conditions is proven by performance.

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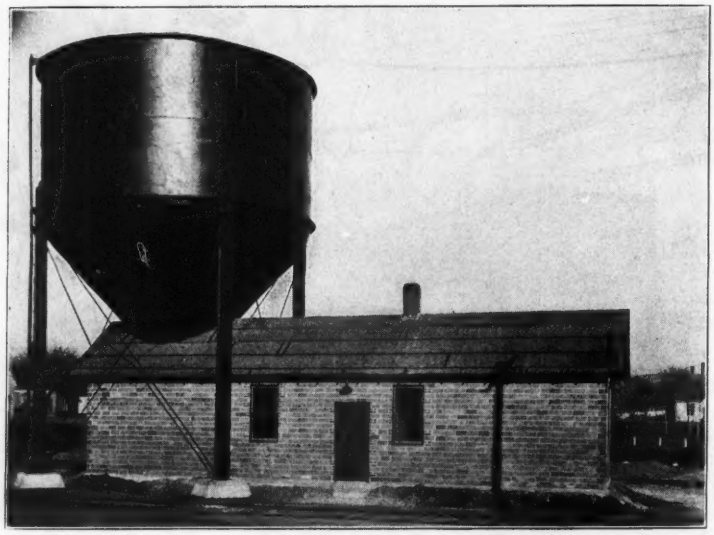

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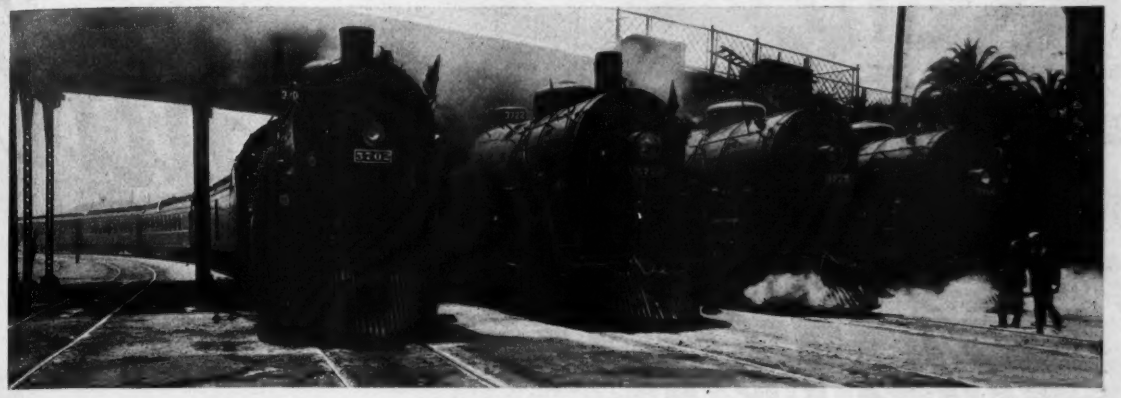

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Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

Vol. 20 **March, 1924** **Number 3**

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How to get the most out of labor saving equipment?

The advantages of longer sections for track foremen?

How track work should be analyzed?

The possibilities and limitations of spray painting?

Answers to these and other practical questions will be found elsewhere in this issue.

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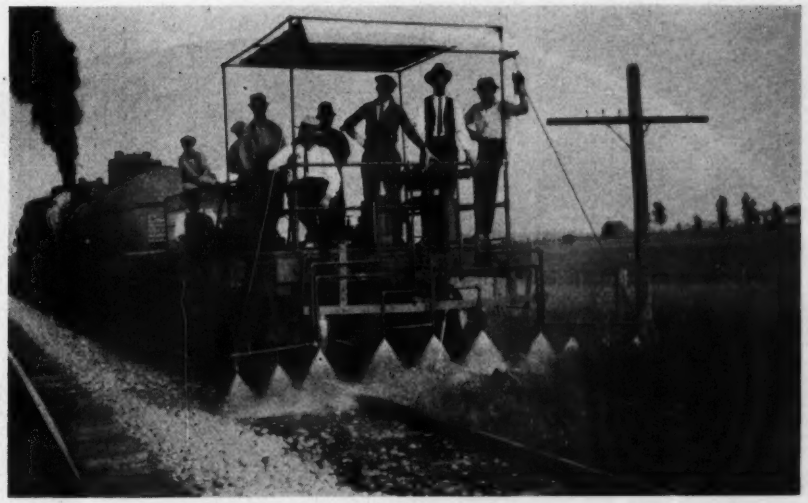

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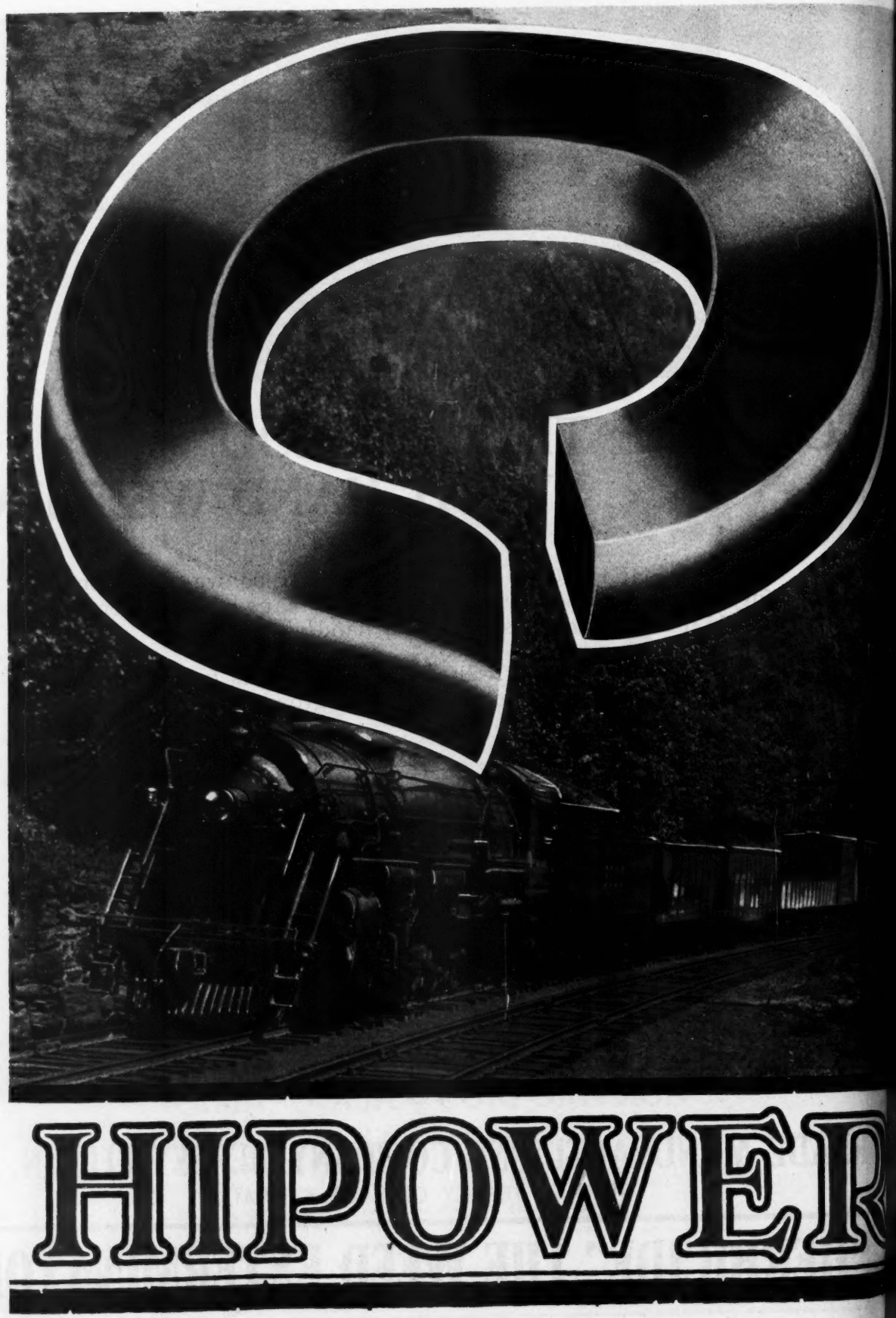
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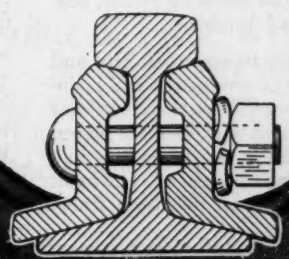
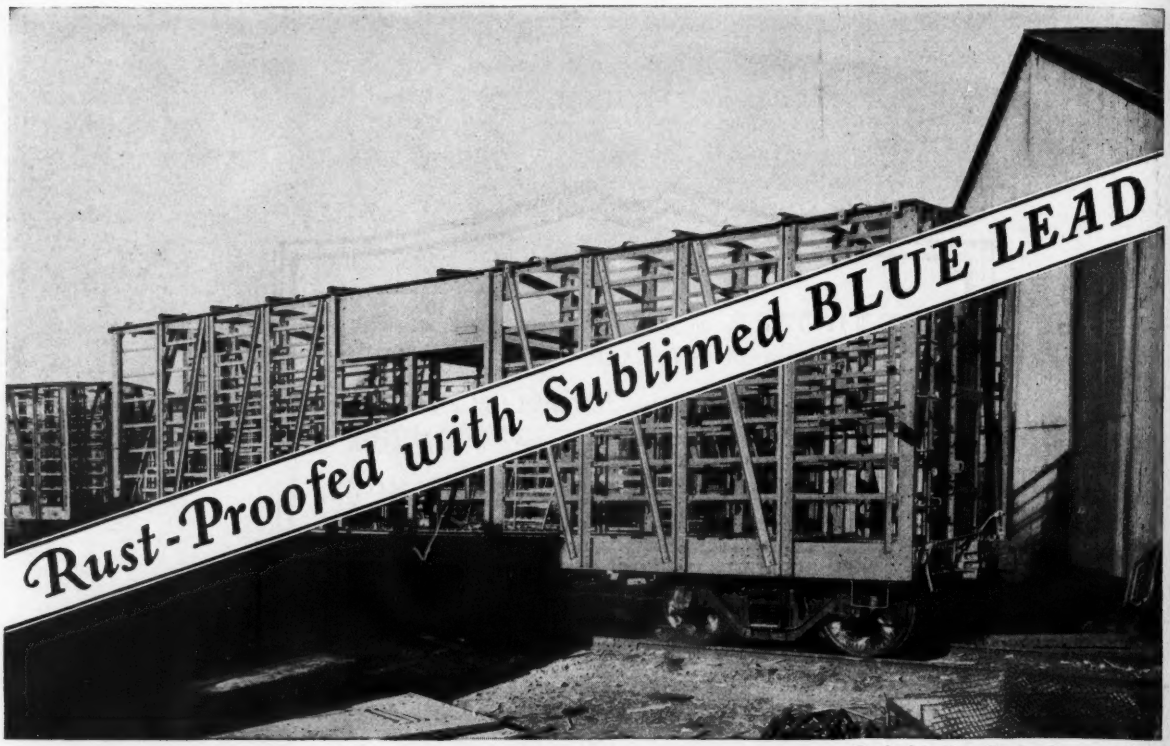


Maintains the Bolted Security of Railway Track Joints



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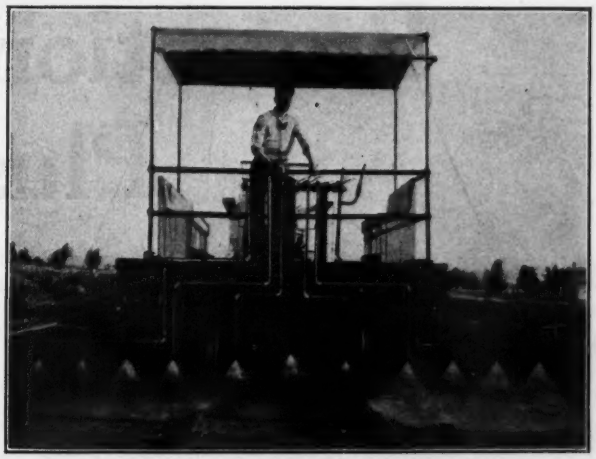

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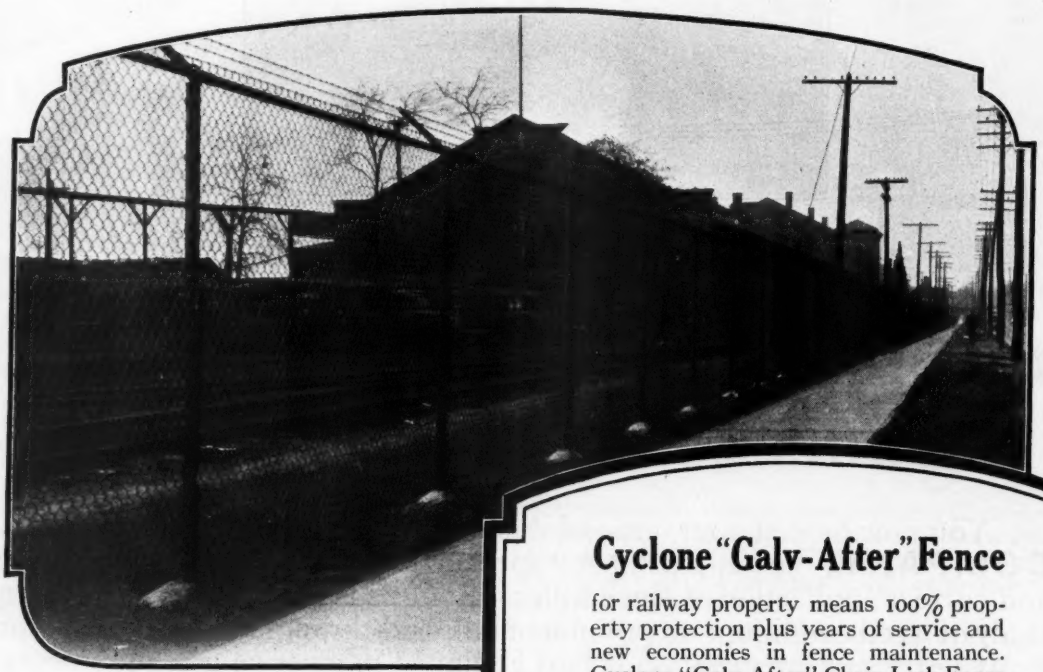

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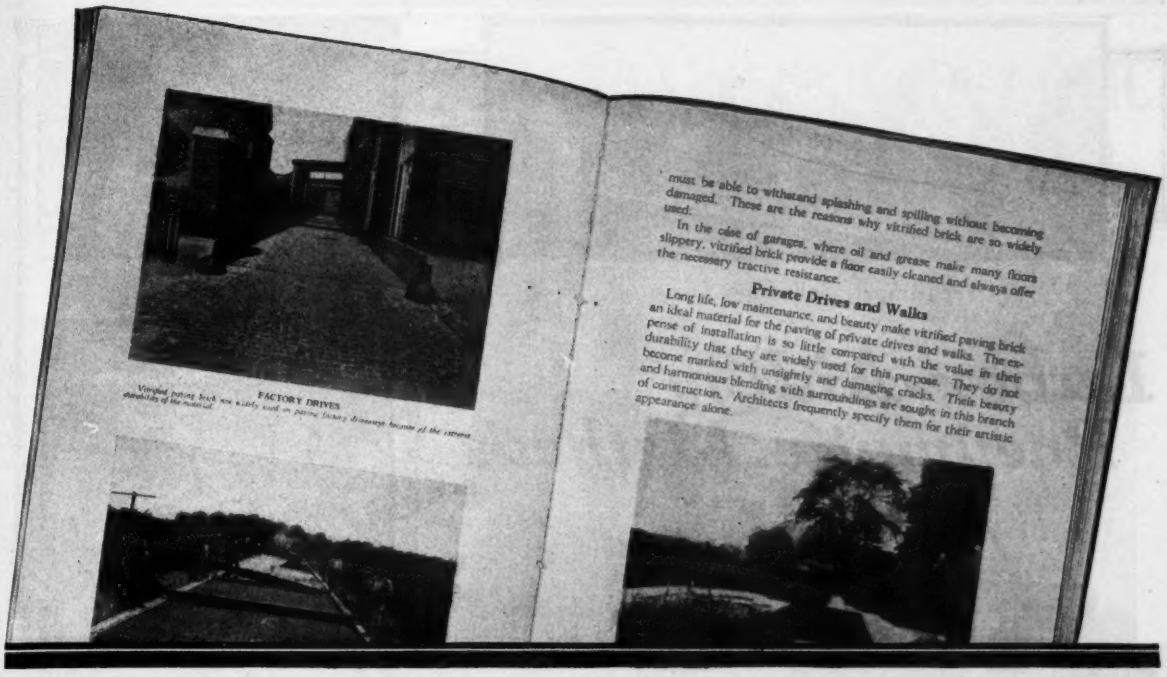
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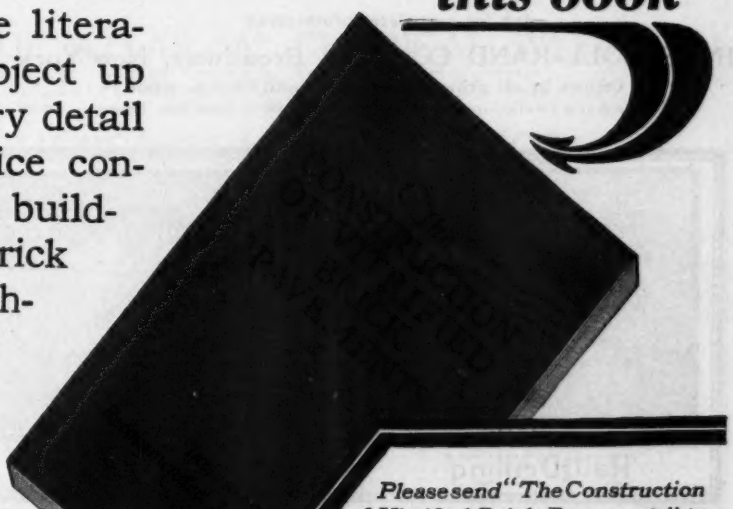

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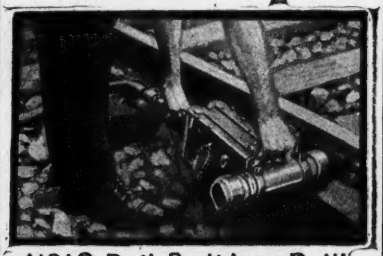

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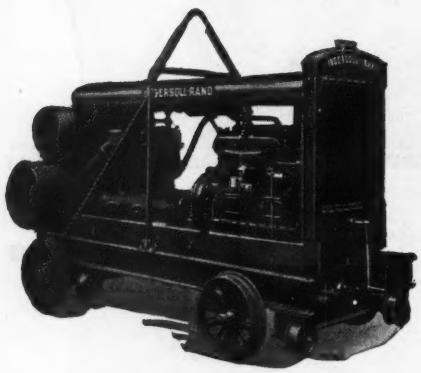

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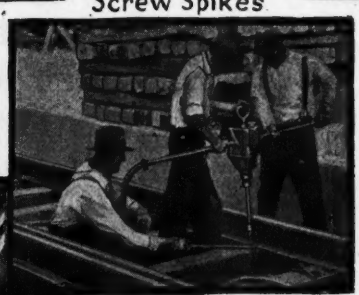

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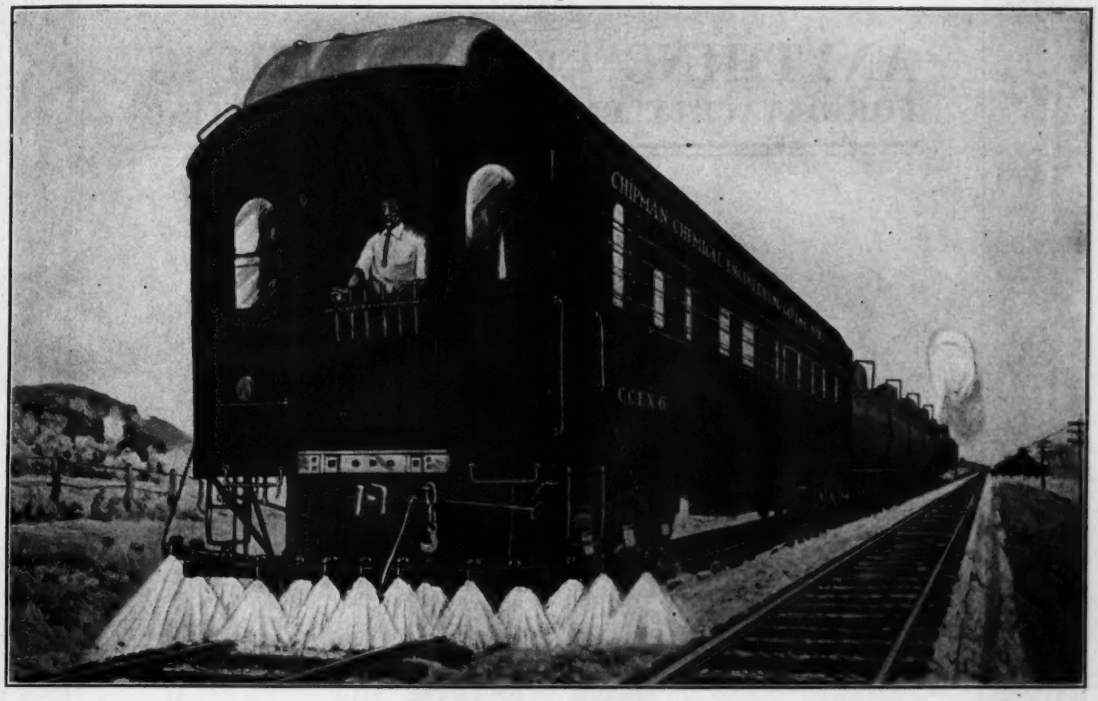

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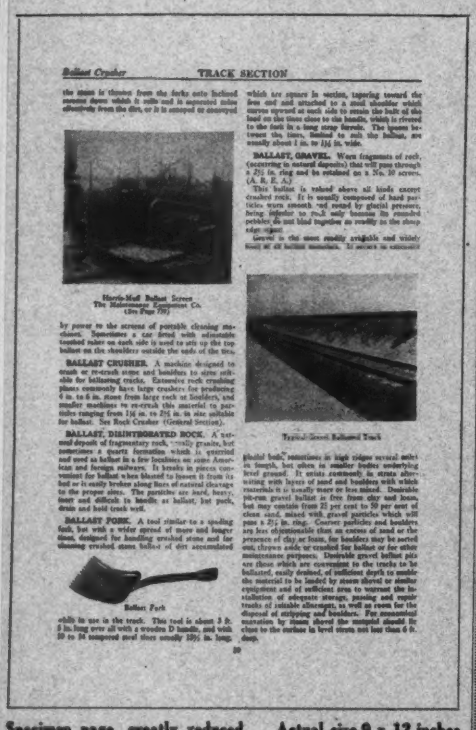

Ballast Crusher TRACK SECTION

the stone is thrown from the forks onto inclined screens shown which it rolls and is separated more effectively from the dirt, or it is conveyed or conveyed

which are square in section, tapering toward the free end and attached to a steel shoulder which curves upward at each side to retain the bulk of the load on the tines close to the handle, which is riveted to the fork in a long strap forward. The spaces between the tines, limited to suit the ballast, are usually about 1 in. to 1½ in. wide.

BALLAST, GRAVEL. Worn fragments of rock, (occurring in natural deposits) that will pass through a 2½ in. ring and be retained on a No. 10 screen. (A. R. E. A.)

This ballast is valued above all kinds except crushed rock. It is usually composed of hard particles, worn smooth and rotted by glacial pressure, being inferior to rock because its rounded pebbles do not bind together as readily as the sharp edge stone.

Gravel is the most readily available and widely used of all ballast materials. It occurs in extensive

Hurrle-Moll Ballast Screen
The Maintenance Equipment Co.
(See Page 791)

by power to the screens of portable cleaning machines. Sometimes a car fitted with adjustable toothed rakes on each side is used to stir up the top ballast on the shoulders outside the ends of the ties.

BALLAST CRUSHER. A machine designed to crush or re-crush stone and boulders to sizes suitable for ballasting tracks. Extensive rock crushing plants commonly have large crushers for producing 6 in. to 6 in. stone from large rock or boulders, and smaller machines to re-crush this material to particles ranging from 1½ in. to 2½ in. in size suitable for ballast. See Rock Crusher (General Section).

BALLAST, DISINTEGRATED ROCK. A natural deposit of fragmentary rock, usually granite, but sometimes a quartz formation which is quarried and used as ballast in a few localities on some American and foreign railways. It breaks in pieces convenient for ballast when blasted to loosen it from its bed or it easily broken along lines of natural cleavage to the proper sizes. The particles are hard, heavy, finest and difficult to handle as ballast, but pack, drain and hold track well.

BALLAST FORK. A tool similar to a spading fork, but with a wider spread of more and longer tines, designed for handling crushed stone and for cleaning crushed stone, ballast of dirt accumulated

Ballast Fork

solely in use in the track. This tool is about 3 ft. 5 in. long over all with a wooden D handle, and with 10 to 14 tempered steel tines usually 10½ in. long.

Texas Gravel Ballasted Track

glacial beds, sometimes in high ridges several miles in length, but often in smaller bodies underlying level ground. It exists commonly in strata alternating with layers of sand and boulders with which materials it is usually more or less mixed. Desirable pit-run gravel ballast is free from clay and loam, but may contain from 25 per cent to 50 per cent of clean sand, mixed with gravel particles which will pass a 2½ in. ring. Coarser particles and boulders are less objectionable than an excess of sand or the presence of clay or loam, for tendency may be sorted out, thrown aside or crushed for ballast or for other maintenance purposes. Desirable gravel ballast pits are those which are convenient to the tracks to be ballasted, easily drained, of sufficient depth to enable the material to be loaded by steam shovel or similar equipment and of sufficient area to warrant the installation of adequate storage, passing and repair tracks of suitable aftercapts, as well as room for the disposal of stripping and boulders. For economical excavation by steam shovel the material should be close to the surface in level ground, not less than 6 ft. deep.

Specimen page, greatly reduced. Actual size 9 x 12 inches

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See other side for directions.

Maintenance Facts

from
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to
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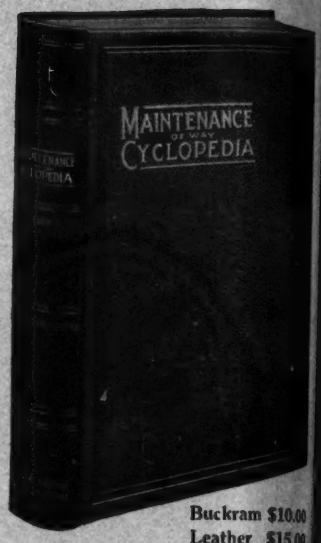

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Maintenance of Way Cyclopedia

Divided—for your convenience—into these eight sections

Track Section

Track laying methods and appliances as well as those used in maintenance work are described and defined. Hundreds of drawings, photos and sixteen large folding plates showing switch layouts, etc., are included.

Bridge Section

Types of bridges and methods used in their construction are described and illustrated. A. R. E. A. specifications for bridge design and erection are given.

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Various types of railway buildings—passenger stations—coaling stations—engine and freight houses, etc., are described and illustrated by photographs and drawings of actual buildings.

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Appliances and tools needed for water service work are described and pictured in a comprehensive manner.

Signal Section

Principles and apparatus used in modern railway signaling are covered. Signal systems are illustrated in detail.

Wood Preservation Section

Treats the subject fully including a key for the identification of woods as well as specifications for different preservative treatments.

General Section

Information regarding construction and camp equipment as well as a large number of tools and devices which are used in more than one of the foregoing sections is given.

Catalog Section

Describes in a specific manner various machines and appliances used in maintenance work and where they may be obtained.

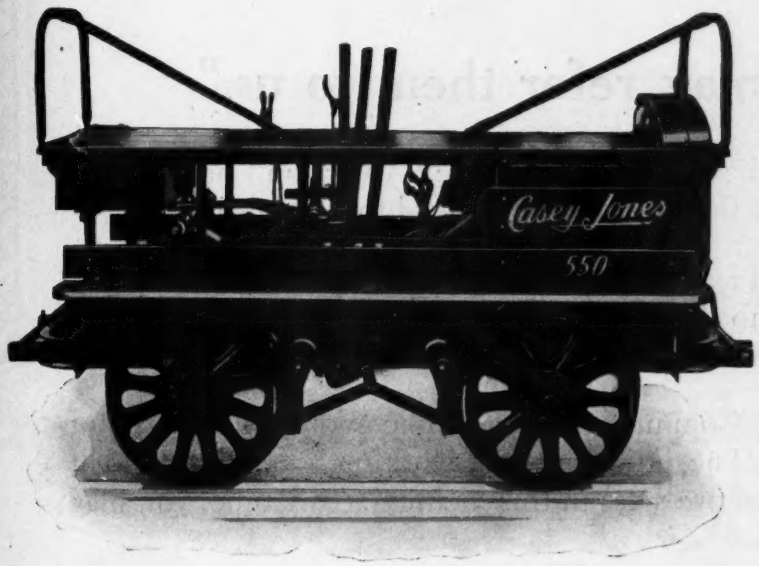
From Section Hand to Maintenance Engineer
Maintenance Men depend on the Cyclopedia

One man ordered a copy because his father had bought the book and he promoted to Section Foreman—he wanted the same help. An Engineer who reached the top of the maintenance ladder writes that he uses the volume constantly for office reference.

In between are hundreds of men in all branches of maintenance work who are finding their copies of *Maintenance of Way Cyclopedia* a daily help. For representative of them is the Division Engineer who pronounced the book "biggest ten dollars' worth I ever got in my life."

Casey Jones Railway Motor Cars

For Dependable Service



Casey Jones 550 Heavy Duty Railway Motor Car

Casey Jones 550

equipped with Standard Ford Motor

The Casey Jones 550 Heavy Duty Railway Motor Car equipped with STANDARD FORD MOTOR is designed to meet the exacting requirements of a powerful motor car for extra gangs, bridge building crews, signal and hump service. The extraordinary strong construction permits uninterrupted service for a long period, the capacity is competent for all uses and the Ford Motor can be serviced at any Ford garage at a minimum cost. Special operators are not required.

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The Casey Jones 520 Standard Section Motor Car is designed to meet the practical requirements of the section crew under all conditions. It is capable of getting the men on the job and back again without delay. The Casey Jones 6 H. P. Ball Bearing Engine is of simple construction and is easy to operate. Composed of 30% less parts than the average motor car engine, it is easy to maintain. Casey Jones has never had a crankshaft failure. The Car complete weighs 920 pounds, light enough for every section crew and still has power and capacity for an extra gang.

Casey Jones 520 Standard Section Motor Car

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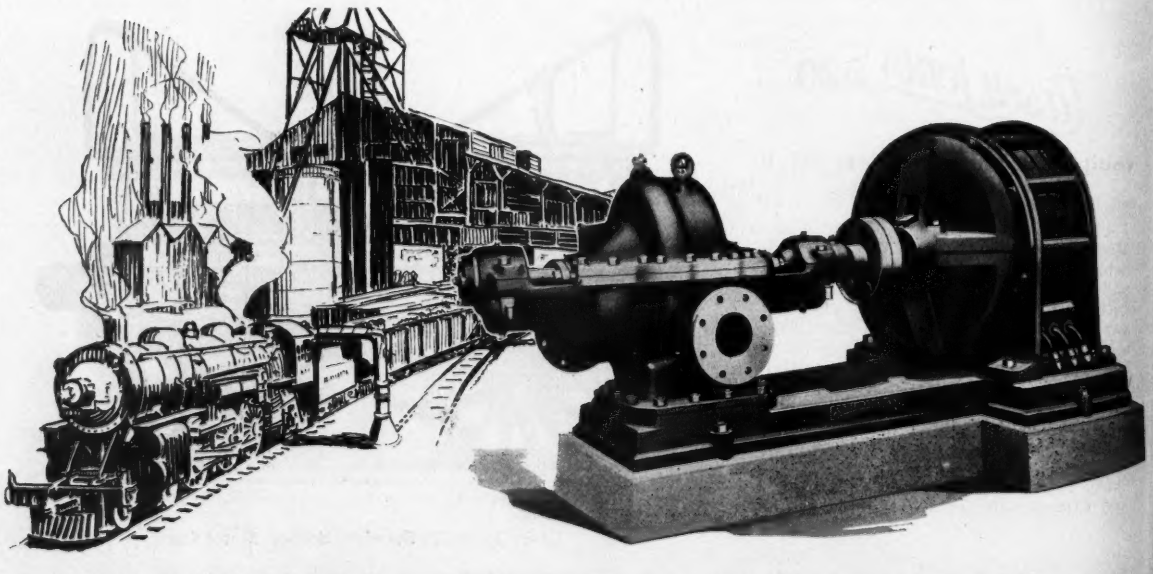

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Creosoting solves every problem in FENCE POSTS

Made in Full Round, Sawed Halves and Sawed Quarters.

SECTION foremen are well pleased when Long-Bell Creosoted Yellow Pine Posts are specified by maintenance-of-way engineers because these posts reduce the labor of keeping up right-of-ways. It is unnecessary to clear grass away from fences when Long-Bell Posts are used.

Preserving full length with creosote, by the pressure-vacuum process, makes Long-Bell Posts resistant to fire and decay. A report of the American Wood Preservers' Association gives these interesting facts regarding the fence posts used by a large western railroad:

A total of 2,030,911 posts in service, 1,651,333 untreated and 378,578 treated. 5,795 of the untreated posts were burned by right-of-way fires as against a damage of only 76 treated posts.

The constantly increasing use of creosoted ties, piling and bridge timbers by railroads is proof of the value of preserved wood. So why not creosoted fence posts?

Write for Further Information about these posts that reduce maintenance labor and expense.

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Can you use a lower-cost explosive?

YOU may have used a certain explosive successfully for a long time but still it *may* not be the most economical.

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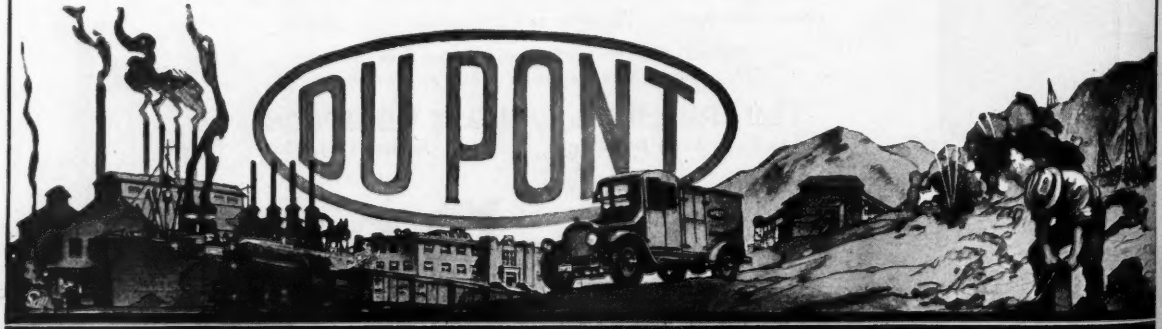
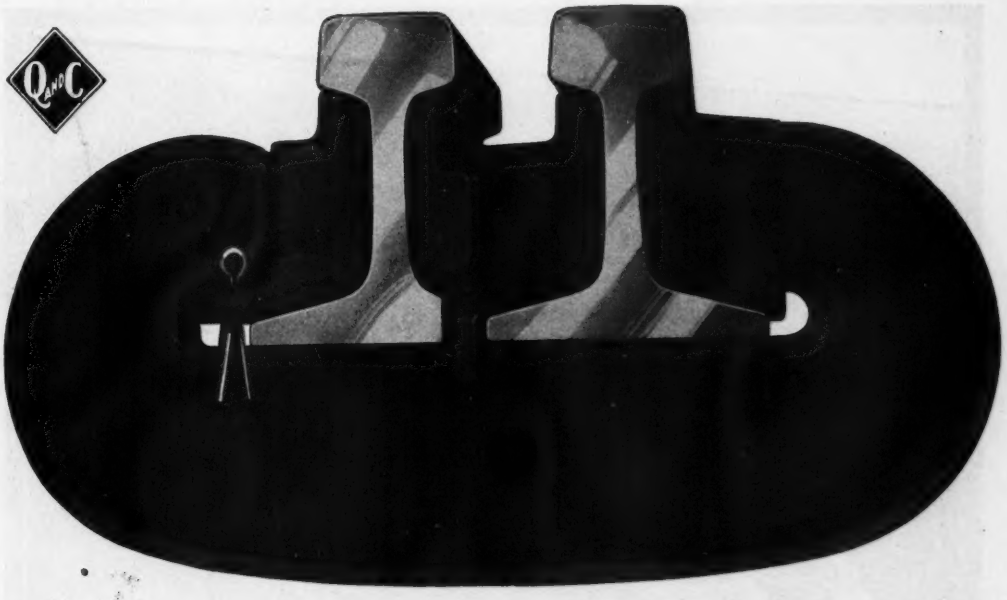


EXPLOSIVES ~ SERVICE

Q & C GUARD RAIL CLAMPS



The Clamp with the Interchangeable Yoke

The Universal design, meaning an interchangeable yoke for all standard "T" sections of rail, makes it only necessary to order new malleable fittings when changing rail sections, and makes it only necessary for the store-keeper to carry one size yoke to fit many rail sections.

The yoke is drop forged with "I" beam construction and made of high carbon steel, heat treated. The wedge is secured in place by a cotter pin. The holes are staggered to permit a fine adjustment, and are drilled (not cored), giving them added strength. The shelf on the wedge and the wide bearing surface of the shoe maintain the vertical alignment of the yoke.

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See the Maintenance Exhibit of the Convention

at Booths 120-139

ARMCO Culverts in Railway Service

No. 4 of a Series

Name of Railway: G. N. R. R.

Location: Main Line, Fargo to Surrey, N. D.

Traffic: Fairly heavy transcontinental passenger and freight.

Installation Data: A 12 ga., 36 in. ARMCO Culvert, under 8 ft. fill of sandy soil. Installed 1910. Under traffic 1912.

Condition: Very slight settlement—condition otherwise apparently perfect. Photographed and inspected May 20, 1922.

Remarks: Investigation reveals that slight settlement such as that noted in the condition of several of these installations is almost wholly due to adjustment immediately after fill is made. Experience shows that once fill is settled, no further appreciable deflection occurs.

There is a manufacturer in almost every state and in Canada, making Culverts, Flumes, Siphons, Tanks, Roofing, etc., of genuine, rust-resisting Armco Ingot Iron. Write for full information and nearest shipping point on products in which you are interested

ARMCO Ingot Iron

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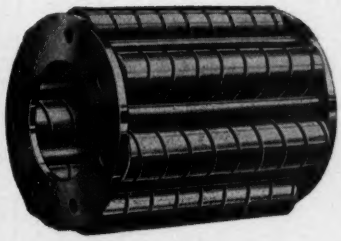
ARMCO CULVERTS

Labor Saving

Railway Maintenance Cars



and Hyatt Roller Bearings

Maintenance cars are labor saving equipment, but unless their bearings are right the cars themselves require a good deal of labor to keep them in running order.

Hyatt bearings are a real labor saving factor in maintenance car upkeep. They require no attention except oiling three or four times a year.

They are practically wear proof and do not require adjustment or replacement. They do not freeze up in winter or overheat in summer.

By specifying Hyatt equipped cars you can make sure of economical, carefree and all-around dependable operation.

Write for information on the development of Hyatt bearings for heavy equipment.

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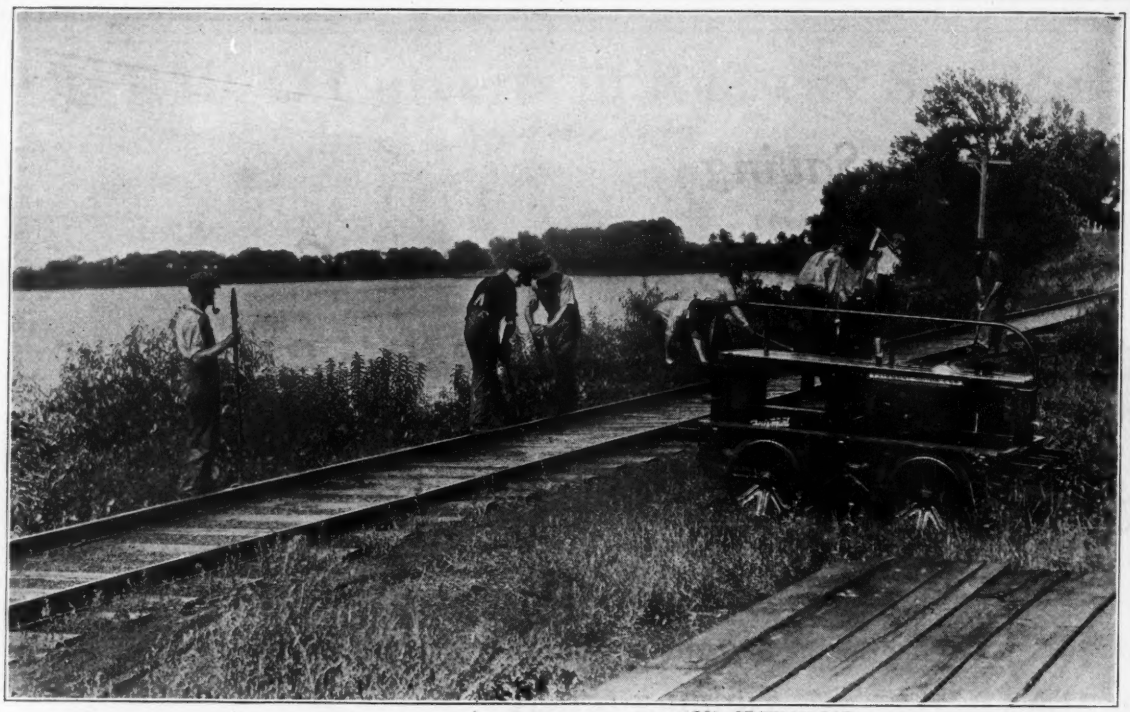

M2-SECTION CAR

Reasons for Fairmont Leadership and Economy

One-piece throttle valve (patented) with single lever engine control. Shoots a stream of fresh gas right to the spark plug when valve is nearly closed. Engine pulls well and runs smoothly at very low speed. Perfect throttle control, another reason for Fairmont economy.

Note These Figures

Time:—A month — one year after being placed in service.

Place:—Division Transcontinental Railroad

Performance:—14 Fairmont M2 gang cars won the confidence of an anti-Fairmont division and fulfilled all the requirements of section gang duty—Covered 4,780 miles during month in question averaging 25.1 miles per gallon of gasoline.

Cost per car per 100 miles:

Operation	.80
Maintenance	.15
Overhead	1.04
TOTAL	$1.99

(Name of Railroad furnished on request)

Performance on the Job Counts

Fairmont Gives Proof In Performance

From a technical point of view the Fairmont Motor Car is a highly advanced example of modern engineering.

From the manufacturing angle it represents the most thorough, scientific craftsmanship.

In actual performance—on all roads, under all conditions, it has demonstrated unequaled service. Whether judged by working efficiency—power, dependability, safety and comfort, or by the dollars-and-cents standard, the Fairmont leads the field.

Challenging competition alike for quality of service and low cost of running and upkeep—it is significant that the verdict of more than 700 of America's leading roads was for Fairmonts. Fairmonts should, logically, be your choice, the next time this type of equipment is up for consideration.

SEE OUR DISPLAY AT THE NATIONAL RAILWAY APPLIANCES SHOW

We extend to you a cordial invitation to see our complete line of engines, section motor cars and inspection cars at the National Railway Appliances Show, Chicago, March 10th to 13th, inclusive. FAIRMONT Booths Nos. 41, 42 and 43.

This and all other details are explained in our bulletins—Write for them.

FAIRMONT RAILWAY MOTORS, INC., Fairmont, Minn.

Fairmont

Ball-Bearing Engines and Railway Motor Cars

Railway Engineering and Maintenance

Volume 20 March, 1924 No. 3

IS LABOR SAVING EQUIPMENT DESIRED?

DO foremen want labor saving equipment? As an indication that they do we may cite a letter we received from a track foreman recently enclosing his personal check for a labor saving device advertised in these columns, with the request that we arrange for it to be sent to him. As a result of his inquiry his road became so interested that it has since arranged to supply several hundred other foremen with the same device.

One may also refer to the thousands of foremen who bought gasoline engines with their own money that they might convert their hand cars into motor cars. On the other hand, not a few roads are finding difficulty in getting their foremen to use equipment of various kinds which they have furnished them. This is an anomalous condition which is causing serious concern to more than one maintenance officer today. It indicates that it is not enough to purchase equipment, but that it is also necessary to coach the men to whom it is assigned to demonstrate to them that the equipment is not only practical, but that it will enable them to get more work done.

All too frequently equipment is failing to show the economies which are expected because of a lack of sympathetic interest on the part of the operator, who is inclined to lay it aside on the slightest pretext. Also, even the most simple machine requires attention and skilled maintenance may be lacking. Whatever the shortcomings, other than in the design and construction of the device itself, it is a problem for the roads to solve. The foremen can do much to raise the standards of their work, and lighten their tasks as well, by co-operating to the fullest extent in making an entire success of the equipment which is furnished them by the railroads.

A DIAGNOSIS RATHER THAN AN AUTOPSY

Adequate transportation service, so absolutely requisite to continued progress and prosperity, can only be obtained when the carriers are permitted to receive compensation based on a schedule of rates that will justify a high standard of maintenance, dependable service, and a reasonable return to the investor in railroad enterprises. The railroads are the dray horse of the nation, and you cannot beat and starve your horse and have him carry the load.

Railroad rates are not the cause of the agricultural depression, and a reduction of these rates is not its cure. It is the old case of over-production. During the war, foreign nations and our own government paid any price asked for the products of the farm. When the war ended, production at a high rate continued, but there were no customers for the product.

No legerdemain of statutory law, no miracle in the way of joint resolutions, can overcome irrevocable and natural laws. The aftermath of a great war, with its endless train of disorganization, extravagance, and the destruction of private and public morale, cannot be cured over night. The recovery rests in courage, industry and decent economy.

A legislative moratorium of two or four years would effect a cure. If not interfered with by adverse legislation, the three controlling parties in interest, the shipping public, the carriers, and the Interstate Commerce Commission, if given reasonable time, could bring about satisfactory results.—*Extracts from an address before the Traffic and Transportation Association of Pittsburgh, Pa., on January 24, by James C. Davis, Director-General of Railroads.*

A LONG SEASON VERSUS A LARGE FORCE

IT requires only the most elementary mathematics to demonstrate that a given force of men should do twice as much work in eight months as in four. Conversely, only one-half as many men should be required to complete a given program of work in eight months as in four. This is the basis on which rests the argument for a longer working season for maintenance of way forces.

The railways have repeatedly pointed to the lack of economy, from the standpoint of national policy, in expecting them to hold in readiness a sufficient amount of equipment to handle a peak load for a few weeks in the fall when this equipment must remain idle for the remainder of the year. They are, however, following the same practice in large measure with reference to their maintenance of way labor, furnishing employment for a few weeks or months and then turning the men loose for the remainder of the year, with the inevitable result that they create a shortage, run up the cost and decrease the efficiency of their forces.

While the financial condition of many roads is not all that might be desired, few are in such straits that they cannot proceed with an orderly program for at least most of their work if they attempt to do so, particularly when it requires little study to demonstrate the fact that the following of such a program will actually save money. The continuance of the practice of concentrating the year's maintenance work in a few months must, therefore, be charged primarily to inertia born of long established habits formed when labor was cheap and plentiful and when the effects of this practice were not pronounced, measured in either the drain in the supply or in the cost. Since the economy of a long

working season is scarcely open to argument, maintenance officers owe it to their roads to put it into effect as early as possible. While it is evident from reports published on following pages that indications point to a supply of labor adequate to meet the needs, except in the more active industrial centers, it is not probable that there will be any marked surplus and proper caution would indicate the advisability of "playing safe" by so developing the season's program as to reduce any undue demands.

The most important step in this program is the beginning of work early in the season. This enables roads to exercise more of a selection in recruiting their forces. It also enables much of the work to be completed so that it will be of service in handling the heavy traffic later in the season. Furthermore, if the harvest fields and other industries should make large inroads in maintenance forces later in the season, the effects will be less severe because of the fact that a considerable portion of the program will have been completed.

While it has been the practice to blame the managements for much of the delay in starting maintenance work, the responsibility rests very generally on maintenance officers because of their inertia in taking the lead and bringing this matter to a head and, where objections arise, presenting their arguments in a sufficiently conclusive form to win their point. No single factor constitutes a greater burden on maintenance of way costs than the short working season. If that burden is to be lifted this year, it is necessary that a program be laid out at once and put into effect quickly.

THERE'S A MUTUAL RESPONSIBILITY

ON page 92 there appears an article by Earl Stimson, chief engineer maintenance of the Baltimore & Ohio, setting forth some of the things that a railway has a right to expect from a manufacturer who is pressing the claims of a labor-saving device. On the following page W. J. Backes, assistant general manager of the New York, New Haven & Hartford, describes some of the measures which a road should adopt to gain the most from its investment in mechanical equipment. These articles indicate the dual responsibility which producer and user bear in the development of labor-saving machinery to the point where its usefulness and economy are demonstrated.

A manufacturer will prosper only if he can sell his product in quantity. A road will purchase this product only if it can be convinced that the equipment will save it money. Not a few devices have encountered difficulties in demonstrating their ability to produce such economies regularly under the conditions encountered in actual service. In some instances, the mechanical construction of the machine has not been sufficiently rugged to withstand the service to which it is subjected. More frequently, the advantage is not in such a form that it can be demonstrated by an actual reduction in the payroll, as, for instance, when a device will save one-half the time of a man, while he must be retained because of his other duties. In fact, it has seldom been the experience that it has been possible to reduce forces, following the installation of labor-saving equipment, and such economies as have been effected have been reflected in an improved quality of work and the ability to raise the standards of maintenance with the same force. As railway men and manufacturers alike are realizing this, the adoption of mechanical equipment is increasing.

A more difficult problem to solve is that of keeping the equipment at work earning a return on the investment. Because of the distribution of maintenance work over such a wide area and the necessity for men to work in small widely separated units, close supervision is impossible. As a result each gang is left largely to its own resources. The successful use of equipment is, therefore, dependent in large measures on the attitude of the foreman to whom it is entrusted. Some foremen are of a mechanical bent and machinery has a fascination rather than a fear for them. More, however, are unfamiliar with such equipment and if it gets out of adjustment they are inclined to lay it aside and to condemn it, with the result that it soon comes to be considered impractical by the supervisory officers.

Since the savings which can be derived from any equipment of this character accrue to the roads, it is to their interest to provide sufficient supervision to insure that the equipment is in a condition to operate at all times. With the equipment in condition to operate it is also necessary to see that it is used, educating the foremen to its advantages and to the measures which should be taken to insure satisfactory service wherever possible, applying discipline where necessary but only as a last resort.

In times of acute labor shortage mechanical equipment is of great assistance. More generally, however, this equipment must justify itself by the economies it effects. With the higher wage rates which have prevailed for the last five years this is less difficult than formerly.

The more general use of labor-saving equipment is inevitable. What other industries have done the railways must do. The field is large, embracing as it does operations now requiring more than 400,000 men, divided between more than 50,000 separate gangs.

THE PROGRESS IN LABOR SAVING EQUIPMENT

THE demands upon the railways within recent years to secure the maximum amount of maintenance work with limited funds has proved to be a real stimulant to the development of labor saving equipment. Thus what was really a hardship at the time and a source of no small amount of worry to the conscientious maintenance man, has, in the end, reacted to his advantage. It is now up to the railways to capitalize on this situation generally. To do this, everyone concerned with mechanical equipment should study its possibilities thoroughly.

Most modern equipment designed for use in the maintenance of way department will produce better results, all factors considered, than hand work. Few classes of mechanical equipment, which are used today in comparatively scattered amounts on different railways, fail to show some savings in the cost of performing work. Those that do not show such savings will generally do the same, or more work, for the same cost but with less labor, a factor which is not always important but is quite vital at other times. Even with equipment of this latter class, it is not unreasonable to assume that with more interested planning and a consequently better organization to handle it, savings in cost will also result.

It is not many years ago that all section work was performed with hard running push cars and hand cars, that all ballast was cleaned with forks, that all rail was unloaded, distributed and laid with tong gangs, that tamping was done with shovels or picks, that ditching was done with large gangs of men and hand shovels; that weeding, when done at all, was done by hand; that cleaning, chipping, brushing and painting on bridges was done by hand, and, so on, for an extended list of items. Many roads still perform some of the work mentioned above by hand, but it is no longer a general condition. In fact, the use of machinery in the form of motor cars, tie-tampers, rail layers, locomotive cranes, ditchers, weed killers, power brushes, chipping hammers and paint spray-

ers, has increased so greatly that it has practically eliminated the older methods on a number of roads.

The adoption of this equipment by the railroads has been slow—prejudice, lack of experience, unsuitable equipment, improper use, all have been influences which it has been necessary to overcome. Yet the result has proved to be worth the effort to introduce this equipment in maintenance of way work, and there should be no reason for hesitancy on the part of the railroads to adopt or extend their present quotas of this class of mechanical equipment.

The day is passing when modern railroads can afford to do without mechanical equipment in any branch of maintenance work. Its use has become too important a factor in the recruiting and holding of labor, in the development of future supervisory forces, in the furtherance of heavy maintenance programs under all conditions, normal or abnormal, and last but certainly not least, in keeping down expenses.

In respect to this latter factor, it is interesting to refer to the results of a recent analysis of maintenance costs from 1910 to 1923. Briefly, this analysis showed that maintenance of way expenses have fluctuated between the relatively narrow limits of from 15 to 20 per cent of the total operating expenses, although total maintenance expenses, including equipment, has risen steadily from approximately 35 per cent to 50 per cent of the total operating expenses. It also showed that maintenance of way expenses over this period remained constant (with the exception of 1920) at between 10 to 15 per cent of the total revenues, although all maintenance expenses (including equipment) increased from about 27 per cent in 1910 to 37 per cent of the total revenues in 1923. Doubtless, numerous factors have contributed to this stability in the maintenance of way department, but when all phases of the question are considered, there is every reason to believe that increased efficiency in the maintenance of way department has been one of the most important factors. Again there is every reason to believe that this increased efficiency in the face of heavier traffic and increasingly difficult working conditions has been greatly influenced by the adoption and use of mechanical equipment, making it possible for the maintenance department to develop better and more efficient methods for the conduct of its work. No foreman who wants to secure and retain men, and no maintenance officer who desires to put his tracks, bridges and buildings in the best possible condition with the money that may be available, can afford to overlook the advantages which the use of mechanical equipment will give him.

A Typical Tie Receiving Yard on a Railroad in the Southwest

Letters to the Editor

A NOVEL SUGGESTION

Eklutna, Alaska.

To The Editor:

I have been reading what *Railway Engineering and Maintenance* has published about the training of section foremen and trackmen. Why couldn't this training be done best in a large central school for all the railroads, established on a tract of land large enough to permit practice work on all kinds of track construction and maintenance with models of the different switches, frogs, curves, etc. It might be well for some of the conventions of the Roadmasters Association to be held at the school so that the members could keep in touch with what the school is doing.

A school of this kind would cost a large sum of money, both for construction and operation, but if all of the roads shared in the expense, it would not be very much for each one and they would derive much benefit from it. One advantage to be gained from such a plan would be the opportunity afforded men from all roads to learn the best methods of doing track work. After a man who is training for a foreman's position has worked in a gang for six months or a year he should have at least 30 days' intensive training at this school before being promoted to section foreman.

Louis Harman.

TAPER RAIL AND COMPROMISE JOINTS

Wheeling, H. Va.

To the Editor:

There are a number of objections to the use of taper rails which were not mentioned in the letters published in the "What's the Answer" department of the February issue of *Railway Engineering and Maintenance* where the relative merits of taper rails and compromise joints was discussed.

A taper rail less than 16 ft. long is objectionable from the standpoint of surface and line, because the joints are brought too close together. If the rails are made 16 ft. or 16 ft. 6 in. long to avoid this fault, then cost would be considerably more than that of compromise joints. In addition to this, most railroads have in use a large variety of weights and sections of rail. To keep a stock of taper rails on hand to meet all the requirements would require large storage space and greater expense in handling. Moreover, the use of taper rails would make it very difficult to make connections between various weights of rail in switch layouts around yards and terminals where switches are numerous and close together.

The compromise joint eliminates all of the objections stated above. They are easily handled and placed by one man. One of the objections frequently raised against the compromise joint is the "pound" at the joint, due to rails not being equally worn, which ultimately results in the breaking of the rail or joint. This same objection could be raised against taper rails and in the latter case the breakage of the taper rail would probably take place first since the original rail section is planed down. In such a case the cost of replacing taper rail would be greater than a compromise bar and the danger greater as it seldom happens that both compromise bars break at the same time.

It is true the taper rails could be planed down to suit

the worn condition of the adjoining rail, but the same can be said of compromise joints. They can be ordered to fit rail worn to any degree mentioned, thereby eliminating any decided offset on the running surface of adjoining rails.

A. H. WOERNER.
Division Engineer, Baltimore & Ohio, Wheeling, W. Va.

WAGE INCREASES AND ADVANCEMENT SHOULD BE EARNED

Herington, Kan.

To THE EDITOR:

In the January, 1924 issue of *Railway Engineering and Maintenance* A. Bolognese presented some views on graduated pay for foremen with which I differ. Of course, almost every foreman and section laborer would gladly *accept* more money for his work, but would they all be eager to *earn* more money? I do not desire to be understood to mean that all of them are now receiving all they earn, for in many cases they are not. Yet many of them are worth but little more to the railroad which employs them after three or more years' service than they were at the end of the first six months, for many of them were men of wide experience at the time they were employed and have improved little or not at all during the course of their service.

To give an increase of one cent per hour to such men after three or more years' service would be unfair to the company, for it would thus be forced to pay a penalty for permitting such employees to remain in the service. It would also be unfair to the employees for the simple reason that the railroad would be required to consider that all of its maintenance of way men were equal, mentally and physically, and could give no consideration to men with experience, greater vision, better judgment, energy, etc.

In promoting young men to the position of foreman it might be well to give them an increase in salary after three years' service, provided they keep on learning and improve their methods of work and the management of their gangs. I am very much in favor of the bonus system, providing it would lead to greater production, which, as I see it, would be the only reason which would justify a company in paying a bonus. Every employee should be promoted when opportunity favors, but each promotion should be based on merit rather than on length of service.

J. ROSH.
Extra Gang Foreman, Chicago, Rock Island & Pacific.

WASTING THE COMPANY'S MONEY

The Northwest

To the Editor:

In late years I have noticed that a lot of money is wasted by the common method of renewing ties. In the fall of the year the roadmaster and foreman go over the line and mark with a stamphammer those ties which they think will not render another year's service. On that basis ties are distributed the following spring and often put in the track. As a result, many a tie is taken out which is sound at the bottom and which, if left alone, would last quite a while longer. Fortunately, some foremen will leave such ties in when they make their examination at the time for renewal, and where this is done many ties may be found with two to four stamphammer marks on them, showing that in spite of a bad appearance these ties are still sound at heart.

The practice of renewing ties in a hurry is also bad. Ties should not be removed out of face but only those should be replaced which are broken or decayed, and even then renewals should be governed by the condition of the track. If the track is in good surface and line it will be weakened by the digging of a hole for a new tie. If they were not required to install ties out of face in this vicinity many foremen woud not put in any ties on certain pieces of track, as much of it is in perfect line and surface and the ties are not so bad but that with the use of tie plates there is entire safety from spreading rails. The roadmaster's answer to this is that he gives orders to every foreman to put any ties back in the track that he takes out that will stand another year's service, which is probably correct, but at the same time these roadmasters will probably remember telling their foremen about their superintendent having received a letter stating that his division was behind with its tie renewals, and then ordering his foreman to get the ties in and inquiring how many are being inserted per man per day.

Under such conditions it is hardly to be expected that the foreman will take the time to put back a tie that he has just taken out of the track; besides, after taking it out and subjecting it to rough handling, even a fairly good tie is damaged so badly as to be unfit for use.

Another source of waste which the track foreman out this way sees is in the handling of scrap. Anybody who has handled cinders to any extent can not but be impressed with the amount of good material that is thrown away at terminals and finds its way into the cinder cars. It seems that the shops get a cleaning mania every so often and dump everything that is not bolted fast. Where cinders are dumped along the track one will find bolts, nuts and scrap of all descriptions. Perfectly good pieces of oak for car repairs, boards and planks, etc., are among the material which the track foreman picks up, brings to the scrap pile and loads up, having reason to expect, moreover, that the very scrap he spent valuable time to pick up and load will greet him on the next cinder car. If the material was picked out before loading the trackman could be doing more useful work and would be in a better frame of mind as well, and the railroad would save money as a result.

OLD TIMER.

New Books

Proceedings of the Roadmasters' and Maintenance of Way Association. Edited by P. J. McAndrews, secretary, Sterling, Ill. 178 pages, illustrated, 7 in. by 10 in. Bound in cloth. Published by the association.

This volume contains the proceedings of the forty-first annual convention, which was held in Chicago, on September 18-20, 1923. In it are corporated reports on The Maintenance of Large Yards; the Education and Development of Section Foremen; Standard of Maintenance of Light Traffic Branch Lines and Labor Saving Devices. Addresses and papers are also presented on "The Present Day Conditions of the Railroads and Their Betterments" by W. G. Bierd, president, Chicago & Alton; "The Political Phase of the Transportation Problem," by F. W. Sargent, vice-president, Chicago & North Western; "The Public's Appreciation of the Railroads" by Hal S. Ray, assistant to president, Chicago, Rock Island & Pacific; "The Roadmaster of the Past" by Colonel F. G. Jonah, chief engineer, St. Louis-San Francisco; "Securing the Maximum Life From Ties," by F. D. Cooper, assistant manager treating plants, Atchison, Topeka & Santa Fe; "Reducing Injuries Among Track Men" by H. M. Mayo, superintendent safety, Southern Pacific lines, Houston, Tex., and "Joint Maintenance," by R. S. Cochran, engineering department, Atchison, Topeka & Santa Fe, Chicago. In addition to the reports and papers themselves, the discussions contain a large amount of valuable information for those interested in, or responsible for the maintenance of tracks.

Track Work in India, Where Labor Is Plentiful and Cheap.

Labor Conditions Will Approximate Those of Last Year

Liberal Maintenance and Equipment Programs Contemplated. Forces Adequate in Most Areas

THE amount of maintenance and improvement work scheduled to be done this year will equal and probably exceed that of 1923. The supply of labor will be adequate except in the most active industrial centers. The high cost of labor, and in some areas its scarcity, are causing the roads to turn more and more to mechanical equipment for relief. These are the principal conclusions to be drawn from reports from engineers in charge of maintenance work in widely separated areas in the United States and Canada.

The maintenance program last year was the most liberal for several years, the expenditures charged to operating accounts alone aggregating $821,380,867. In addition, correspondingly large amounts were spent for improvements and additional facilities. The heavy traffic which prevailed throughout the year and which has continued up to the present time has increased the wear and tear on the property so that more must be spent for upkeep this year. This traffic has also resulted in increased earnings, so that, in general, funds are available with which to make these repairs. As a result, the allotments for routine maintenance and also for improvement work will be as great as those of last year, and in many cases larger.

Although doing more work than in any recent year, the railways suffered relatively little from the shortage of labor last year. Such deficiencies as existed were confined to the larger industrial centers in the eastern states. This was in marked contrast with the indications which prevailed early in the spring. The danger of an acute shortage was overcome by the more efficient use of labor through the extension of the working season, the more general utilization of mechanical equipment, and other expedients. The results which were secured last year demonstrate that the acute shortages which have been experienced in the past have been due in no small degree to the lack of comprehensive programs for the season, and demonstrate the marked extent to which it is possible to overcome their effects. Building on the lesson learned last year, there is relatively little fear of a shortage this year.

Particularly encouraging is the trend toward more general use of labor saving equipment to increase the output and reduce the number of men required, and also to reduce the cost of this work. While the introduction of labor saving equipment brings new problems which must be solved, the reports which are presented below indicate that railway men are taking cognizance of this fact. As a result, the utilization of labor saving equipment may be expected to expand rapidly within the next few years.

The following are abstracts of reports which we have received from engineering officers, carefully selected because of their ability to report on conditions in various parts of the country.

Less But More Efficient Labor Predicted in New England

The Boston & Albany contemplates the installation of approximately 10,000 tons of 105 lb. Dudley section rail and about 100,000 yds. of rock ballast, the rebuilding of quite a large number of culverts and extensive repairs to a number of overhead highway bridges during 1924. There does not seem to be much prospect for any

additional trackage being constructed. The regular track and building maintenance will be carried on as usual.

The outlook for an adequate supply of labor indicates no improvement over 1923. In fact, it is probable that the labor supply will be somewhat shorter. The efficiency, however, was much improved during 1923 and the indications are that this will continue.

The prospect for the use of labor saving equipment and materials is excellent and is steadily improving, as this class of equipment is developed more practically. *F. B. Freeman, Chief Engineer, Boston & Albany, Boston, Mass.*

Canadian Outlook Same as in 1923

As far as I can learn the outlook in Canada for 1924 is very similar to 1923 as far as the available supply of labor with a very slight reduction in the general program of work. *Maintenance Engineer, Canadian road.*

Much Work in Prospect in Pittsburgh-Youngstown District

The amount of maintenance work will be considerably heavier than normal on the railroads generally in this vicinity, due in part to the extraordinary traffic during 1923 and also to a certain amount of deferred maintenance work which has not yet been caught up. In addition the early indications are that all of the roads will expend large sums in improvement work this year. Although most of these projects are relatively small, they are numerous, so that the aggregate will amount to a large sum of money.

Indications point to a continuation of the shortage in common labor which was experienced throughout the industrial districts during 1923, and the probabilities are that this shortage will become more acute. The iron and steel industries are now operating practically at capacity. The eight hour day, which is now general throughout the steel industry, was not adopted until late in 1923, so that there is now and will be a considerably larger force of men employed in the mills than was the case last summer; in fact, the supply of good common labor in this vicinity is practically absorbed at the present time, so that the railroads will find it necessary to recruit their forces from the less desirable classes. In building trades enough projects of major magnitude outside of the railroad field have already been announced to make it necessary to import skilled mechanics in all these lines into this district, and there is sure to be a considerable amount of bidding for the services of this class of labor by early spring.

In view of these conditions the year should be more than usually good for the manufacturers of labor saving appliances and equipment. The railroads generally have made their heavy purchases of locomotives and rolling stock and are in far better condition than was the case last year, in this respect. It is only fair to assume, therefore, that there will be more funds available for the purchase of those tools and appliances which will reduce the number of men needed to carry out the work program of 1924. *H. Knight, regional engineer, Ohio region, Erie, Youngstown, Ohio.*

A Busy Season in the Pocahontas Territory

The maintenance of way outlook through the territory extending diagonally across Indiana, northern Kentucky, southern West Virginia and central Virginia to the Atlantic coast, indicates a rather heavy program, both in maintenance and improvement. The outlook in the freight producing section is favorable and increased loading is expected. The program of work is planned to take care of the development.

There does not appear to be any reason for anticipating any material change in labor conditions through this section. The usual periodical shortages in sections where seasonal and industrial conditions control may be anticipated and programs of work are prepared on the basis of allowing increased forces during periods when labor can be secured and sending extra gangs into territories of labor shortage, which practice tends to equalize the conditions.

The character of the labor in this territory remains substantially the same and is not greatly affected by any gradual change in industrial conditions. Forces, as a rule, retain a nucleus of regular employes and are increased during busy seasons by adding native labor. It is expected that this condition will maintain during the coming season.

The more general use of labor saving equipment and methods becomes necessary each season and equipment is added as the necessity demands. Each year more ditching is done by machines. Rail laying and material handling machines are added to the equipment. The general result is that the force remains practically the same while the increased work required to be turned out is accomplished by the use of more labor saving equipment and more efficient methods, thus accomplishing the net result of performing more work each season with little extra cost. *L. B. Allen, superintendent maintenance of way, Chesapeake & Ohio, Richmond, Va.*

Much Construction in South

It appears that a normal amount of maintenance work will be done in this territory, while there is considerably more construction work under way, than for several years.

The supply of labor at this season of the year is good and the quality is also good. Naturally this supply falls off in the summer when there is a much greater demand for labor. However, it does not appear that there will be a very noticeable labor shortage during the coming season.

The sentiment in favor of adopting labor saving devices, wherever economy can be shown, seems to be growing and I believe will continue to grow. Such devices not only dispense with the necessity for a considerable number of men, but do the work better than it could be done by hand. The principal labor saving devices are motor cars, tie tampers and bonding outfits. *J. R. Watt, General Roadmaster. Louisville & Nashville, Louisville, Ky.*

Labor Saving Devices Receiving Increasing Attention in the Central West and South

Our present plans contemplate our carrying on what may be considered a normal maintenance program. Our rail renewals will amount to about the average on our system for the past several years. On account of the large number of treated ties which we have been applying on our property in the past, our tie renewals will be slightly less than previous years. Ballast renewal, ditching and banking, and other general maintenance work contemplated, will be approximately the same as they have been in the past several years. We have a great deal of improvement work which was carried over from 1923 and which will be carried on during the current year. In addition to this it is contemplated that some additional new work will be opened. As a whole, the present plans for improvement work for 1924 are about on the same basis as they were in 1923.

As I view the situation there will not be any more demand for labor in railroad work or other industrial activities during 1924 than there was in 1923, and from

the present outlook and my general knowledge of the labor conditions, I do not anticipate any serious labor shortage during the current year. I believe that the character of labor available for our work will not differ greatly, if any, from what it was in the past year.

It is our policy to make use of labor saving devices as far as practicable, and during the current year we contemplate substantially increasing the number of labor saving devices, tools and equipment, which we have. *A. F. Blaess, Engineer Maintenance of Way, Illinois Central, Chicago.*

Last Year's Conditions Will Be Repeated in Central West

From what I have seen and heard I believe that the maintenance and improvement programs of the different roads will be about the same in 1924, as far as the amount of work performed is concerned, as in 1923. The forces, as near as I have been able to learn, for both maintenance and improvements will be about the same as for last year.

The labor situation will be about the same this year as in 1923. The building program in the cities will be continued, but probably will diminish somewhat and some labor should be released from this class of work after the middle of the year. The same applies to hard road work, so that I can see no prospect of any shortage of labor during 1924. With the exception of a month or two in the spring of 1923, we had no shortage of labor during that year.

There is a steady increase in the use of labor saving machinery on the railroads and, in my opinion, this will continue on practically all of the roads. We have all been installing spreader-ditchers, tie tampers, track liners, ballast shoulder cleaners, track mowers and other devices. Few, if any roads, are fully equipped with this class of machinery; they have been adding equipment of this kind and, in my opinion, will continue to add to it during 1924. All of this tends to reduce the requirements for labor. The use of treated ties and bridge materials has been increasing and each year additional railroads reach the point where they are getting reductions in the amount of material required, due to the longer life of the treated material. This means a decrease in the amount of trestle bridges to be renewed and ties to be inserted. The gradual replacement of wooden platforms at stations with brick, concrete and asphalt is reducing the amount of labor required for this purpose, as is also the use of improved types of road crossings. On the other hand, the increased demand for the separation of grades with public roads and the resumption of track elevation work in Chicago is calling for an increased amount of labor. Also, the effect of the increase in the weight and size of locomotives is calling for the strengthening of roadbed and bridges, the extension of stalls of roundhouses, larger turntables, etc. The result of this is, that while we are saving labor by the installation of labor saving machinery and improved materials, the labor requirements are not materially reduced on account of the new demands for improvements. *C. A. Morse, Chief Engineer, Chicago, Rock Island & Pacific, Chicago.*

No Unusual Work Contemplated in West

Within the districts through which the Union Pacific operates, I do not know that any extensive railroad construction or reconstruction or any large public work is being contemplated this year. Neither do I know of any more than the normal year's city and town building activity or unusual authorizations in highway work.

It seems probable that the requirements for common labor will be met by local supply (which is always preferable) or by supply from nearby markets up until about May 1. After that date the usual activity in outside work, including agricultural work, as in any ordinary year, will no doubt require the importation of common labor from outside.

Every reasonable consideration is being given in this territory to labor saving devices, as a measure of economy, as well as expediting the work, safeguarding the men and saving them from unreasonable or long continued heavy lifting. *R. B. Robinson, Engineer Maintenance of Way, Union Pacific, Omaha, Neb.*

Much Work Under Way in Texas and Louisiana

The Southern Pacific Lines in Texas and Louisiana expect to continue throughout 1924 the program of improvement and strengthening of track, roadbed and structures which has been under way for the past three years. The work for this year will consist principally of about 500 miles of ballasting, 250 miles of ballast reinforcement, 150 miles of rail renewal, the replacement of numerous trestles and the improvement of shop and terminal facilities. This work will continue to require track forces considerably in excess of those needed for ordinary maintenance.

There are no indications at present of any track labor shortage this year in this territory other than that which usually exists for two or three months in the fall during the cotton and sugar harvesting seasons. Mexicans and Negroes will continue to make up the larger part of the track labor supply. White men are used exclusively in bridge and building work and the supply is expected to be ample throughout the year.

While the need for labor saving equipment is not so acute in this territory as in the northern and eastern states with their more intensive industrial development, such equipment as promises to effect material savings in the cost of maintenance is gradually being acquired and put into use. Ditchers, spreaders and improved types of ballast cars, an increased number of motor cars for section and extra gang use and various minor labor saving devices for track and bridge and building gangs constitute the principal items of this new equipment. The use of chemical weed killers is being extended from year to year. *H. M. Lull, chief engineer, Southern Pacific Lines, Houston, Tex.*

A Normal Program in the Southwest

As far as I am informed the usual amount of maintenance and improvement work is planned and a considerable amount of it already approved, so that I am quite sure that the maintenance and improvement programs of the railways in this vicinity will keep the properties up to standard. The labor situation appears to be satisfactory. I know of no railway labor shortage in our territory. The use of labor saving equipment is on the increase and acceleration in that direction will undoubtedly be advantageous. *J. L. Campbell, Chief Engineer, El Paso & Southwestern, El Paso, Tex.*

A Normal Program in the Northwest

We expect to carry on about the usual amount of maintenance work but our improvement budget will be somewhat less than in the past few years. At the present time, the outlook for an adequate supply of labor seems to be good, although the situation may change very rapidly with the opening up of road construction and other such work.

We are installing a certain amount of labor saving equipment each year and thereby reducing the amount of labor necessary. *Engineer Maintenance of Way, Northwestern road.*

What Has a Railway a Right to Expect From Mechanical Equipment?

The Requirements Which Must Be Met Before a Road Is Justified in Purchasing Machinery

By EARL STIMSON,
Chief Engineer Maintenance, Baltimore & Ohio

WHEREVER the machine has been placed in competition with hand labor, the machine has ultimately demonstrated its superiority. The machine has supplanted hand labor in almost all lines of industrial activity. However, it is only in the last few years that the machine has been applied to railroad maintenance of way work.

In the past the plentiful supply of cheap labor has, no doubt, been responsible for retarding the introduction of the use of mechanical equipment and devices for this class of work. With the higher price of labor and the more frequently recurring shortages of labor, the attention of the maintenance engineer is now being focused on the necessity for reducing costs and conserving the labor supply and he is now rapidly following and is meeting this necessity by an ever extending use of mechanical labor saving equipment.

Machines are substituted for hand labor usually for the very practical reason that the work can be done more economically with them. General business conditions and individual situations peculiar to certain properties are often such as to warrant the adoption of certain mechanical appliances in order to conserve the available labor supply and to expedite the work, irrespective of whether a definite saving is effected or not. Generally, however, it may be stated, as a governing objective for manufacturers, that the machines proposed must be capable of doing work more economically than it can be done by hand.

In the order of their importance we may state the reasons that guide maintenance officers in their decisions to adopt the use of machines, as follows:

(1) Reduction in costs.
(2) Conservation of labor.
(3) Mass production.
(4) Expedition of work.

Discussion here is limited to those machines which are portable, and are designed for ready movement to locations where they may be needed. Such equipment, representative of the progress made in the use of labor saving machinery, is shown by the following list:

Heavy Equipment	Light Equipment
Steam shovels	Motor cars
Steam ditchers	Rail laying machines
Pile drivers	Power tie tampers
Locomotive cranes	Ballast screens
Derrick cars	Concrete mixers
Air dump cars	Cement guns
Spreader cars	Power drills
Ledgerwood unloaders	Power wrenches
Unloading plows	Paint sprayers
Ballast screen cars	Weed cutters
Rail Saws	Cutting and welding torches
Track laying machines	

Numerous other kinds of machines designed for the many detail operations in maintenance work are manufactured, but in common with some of those in the above list, have had but limited use. In fact, the restriction has been so great as to justify the query, sometimes raised, as to whether maintenance officers have been awake to the advantages offered by the numerous manufacturers, who claim that their machines will be of service to the roads.

Without entering into a discussion of the merits of any of the particular types of machines that have been or may be offered, it is desired to state a proposition that may in general serve to advance the progress in the adoption of machinery for maintenance work. No maintenance officer is going to recommend the use of a machine which, through analysis of its design, can be proven to be more costly in operation than would be the use of hand labor. Yet such machines are being urged today as labor saving devices. Neither will any machine that fails to show definite savings through comparison under actual service conditions have much chance for extensive sales. Unquestionably, there has been unfavorable reports based upon erratic data and there probably has been condemnation of machines which have not received a trial under fair conditions.

Approximately 65 per cent of maintenance labor is expended upon the roadway and track and therein are the greatest opportunities for the use of labor saving devices. Employes in that work are least skilled in the use and care of mechanical appliances and, notwithstanding the assignment of trained mechanics to look after the equipment which trackmen use, these machines are subjected to severe service, oft-times lacking that close attention to lubrication and repair, at the time when needed, which a trained mechanic would give. The result is time lost in the attempt to adjust the trouble, a machine out of service and the reversion of the gang to the old method of working, which this particular machine was designed to supersede.

These conditions impose obligations upon both manufacturers and railroad officers. Machines offered for service should be designed to insure economies in operation and be of such simple design and substantial construction that, under the usage and care which they will ordinarily receive, they will operate continuously throughout the days of the working season. It is the users' obligation to organize the work in connection with the use of machines so that full efficiency of the units will be developed, and further to see that reasonable care in their operation and maintenance is exercised.

Further, maintenance officers should make definite studies of the comparative values of devices which have sufficient merit at least to justify their trial. Expressions of opinions from the foremen or the operators are valuable, but more convincing is the accurate analysis of the engineer who is assigned to or will undertake the study of all the phases relating to the economy of the operations. Too often is approval or condemnation voiced after an observation of some minor detail, commendable or discreditable within itself, but relatively unimportant in its affect upon the whole cost or economy of the performance. Accurate analysis of service is essential to a just determination of value.

Four Rail Unloaders in a Work Train.

Organizing to Secure Economies From Labor Saving Equipment

Detailed Work Programs, Supervision and Repair Facilities Are Necessary to Get Results

By W. J. BACKES,
Assistant General Manager, New York, New Haven & Hartford

BECAUSE of the higher wages paid by other industries during the war period, a majority of the experienced track men left railroad service and obtained permanent employment elsewhere. These men are now holding positions as skilled laborers at still higher rates on account of the scarcity of high class labor. This condition is being continued to a considerable extent by restricted immigration. The railroads, in consequence, are compelled to take such labor as is available at their current rates, and this labor is not to be compared, from the standpoint of efficiency, with that obtained in former years.

Furthermore, the tendency of these men to move from one job to another has resulted in a large increase in the labor turn-over, with a consequent reduction in efficiency. It is, therefore, continually necessary to break in new men to handle work of the character performed by track labor, which work requires considerable experience and skill.

The men today are not capable of doing or will not perform as arduous service as the men in the past. As a consequence, the use of labor saving devices has become almost a necessity in order to overcome the inefficiency and inexperience of the majority of the laborers now obtainable. This is particularly true of devices for handling heavy materials to relieve the men of heavy lifting and for use where long continued physical effort is otherwise required.

When many of these devices were first introduced, they were usually individual machines, assigned more or less indiscriminately to independent foremen. They were maintained by the foremen and their performance varied directly with the enthusiasm developed by the foremen for performing work with the machines and also with the foremen's natural ability for taking care of them. With the increase in the units and types of equipment and the constant turn-over of forces, it has become essential that an organization be established which will have general supervision over and maintain all such equipment. The success in the use of modern labor saving devices depends largely upon the ability and the enthusiasm of those charged with the planning and laying out of the work to be done by the equipment and the esprit-de-corps and loyalty of the organization responsible for the performance and maintenance of the equipment.

A Detailed Work Program Is Essential

In order to obtain the full economy and efficiency possible from the use of modern labor saving devices, it is absolutely necessary that a very detailed program be laid out. This should not be confined to a supervisor's territory or a division, but should extend over the railroad as a whole, and the equipment should be moved from division to division in accordance with the program.

That the equipment should be in first-class condition as the work is started in the spring goes without saying. This can only be accomplished by having an organization charged with the sole responsibility for the maintenance of this equipment. With the large amount of the equipment on the average railroad today, the employment of experienced work equipment supervisors of the highest order is fully warranted. The failure of any part of the equipment on large operations means serious delay and loss of time and economies that might otherwise be expected fail to materialize. By placing the responsibility for the condition of the equipment upon a general supervisory officer in charge of work equipment, who is able, by reason of his experience, to insure that the equipment is in proper working order when work is started and by the assignment of a sufficient number of experienced mechanics with necessary repair parts and extra equipment, it is possible to eliminate those delays and interruptions, which have resulted when these matters were placed in charge of men working independently.

The necessity for regular and periodical inspection and the making of repairs by men whose sole duty is to inspect machines and make minor repairs, has taken away from the disinterested foreman the excuse that his equipment was not working properly because it was out of condition for one reason and another. These inspections, supplemented by regular reports sent to the supervisor in charge of all equipment, permit a very accurate check, not only of the performance as shown by the work performed, but also of the efficiency in maintenance of the machinery under the charge of each foreman. This system of inspection also permits minor repairs to be made promptly and thus carry the machines through the season without serious delay, whereas where this system is not generally in use, minor repairs are neglected, resulting in machines going out of service completely within

Applying Nuts with a Power Nutter

a comparatively short time and in greater costs for repairs and also the loss of the use of the equipment. This inspection does not relieve the man in charge of the equipment of the responsibility for maintaining it, but is merely a check upon his performance and assures him of assistance and advice from time to time.

With larger machines such as Brownhoists, steam shovels and ditching machines, it is quite important that the crews themselves be required to maintain the equipment under their charge with the assistance of the inspectors from time to time. This can best be secured by having the crews go to the shop with the machines when they are overhauled, as generally more satisfactory service can be had than if the machines are merely turned over to men who have no direct interest in their operation.

A Maintenance Shop Insures Better Equipment Condition

On the larger railroads the amount of work and labor saving equipment has increased to the point where it has been necessary, in many instances, to establish a shop where all of the repair work can be done under the general direction of the supervisor, who is held responsible for the condition and repair of this class of equipment. With such centralized facilities it is possible to send all equipment out of service to this shop where it can be overhauled, white-leaded and made ready for use on demand. A shop or concentration point of this kind insures that many of the small items of equipment such as half-yard concrete mixers, small gasoline, tie-dapping machines, nut runners, spike drivers, bond drilling machines, tie tampers, etc., are not lost sight of by being stored away in some section or freight house along the road. Under the shop plan the equipment can be charged out to the man to whom it is shipped and he can be held responsible until it is returned. The shop in turn can be held responsible for its condition when shipped out. With such a plan it is possible to make a complete inventory each winter and to line up the equipment for repair to meet the program of the coming year.

Some Disadvantages of Former Methods

The indiscriminate distribution of labor saving equipment without a definite plan or program usually results in serious inefficiency. The few men who take kindly to these devices often use them in an indifferent manner, due to their lack of knowledge of how to obtain the most out of the machines and of the important details of maintenance that are known to a more experienced operator. The remainder of the equipment is generally in the hands of men who are not interested and it is usually sidetracked and not used at all.

Where no instructions are issued and followed up, machines are often supplied with improper fuel and lubricants, causing poor performance and, very often, abuse of the machine, with the result that the equipment generally is in an improper condition to be used. This usually ends in delay to the work, annoyance to the foreman and general condemnation of the equipment. This is particularly true in regard to internal combustion engines which often fail at the most critical time, causing a marked loss in the time of the men and the services of the machines. Neglect is particularly bad in the winter, since equipment that is water cooled is often permitted to freeze and cause serious damage.

The conditions outlined above are merely made worse where poor supervision is provided, as the enthusiasm and interest necessary for obtaining the maximum efficiency from the machines is lacking. Improper repair facilities result in the machines not being in proper condition to start the season's work and, because of this, the efficiency that should be gained by a well organized and coordinated plan is lost.

The work in the maintenance of way department is done largely by uneducated men. The methods of doing this work must be changed from time to time in order to meet the changes in conditions which come about through the use of heavier materials, increased traffic, etc. It is, therefore, necessary to carry on a continuous educational campaign with foremen and supervisors, in order that they may keep step with the progress made in other lines of endeavor. Labor saving devices cannot be used successfully without a proper educational program. Education, therefore, is the first step in the successful use of these devices.

Labor Saving Equipment Permits the Use of a Better Track Structure

The motive power department has very materially increased axle loads in the last 15 years. The maintenance of way department, with a few exceptions, has done little to meet this increase. The mechanical tamper has, within certain limits, made it possible to maintain track to better line and surface than would have been possible by hand with the present class of labor, but the ultimate solution of this problem lies in the use of a heavier rail of a high girder section which will give the maximum distribution over the roadbed. By using such rail, creosoted ties and stone ballast, and by giving the track a general raise in conjunction with tie renewals when the rail is laid with modern labor saving equipment, track can be put up which will stand as long as was the case with the old hand method of 20 and 25 years ago.

The supply of labor is generally less on the lines of heaviest traffic, due to these lines passing through the larger centers of population where demands for labor by

outside industries and public activities draw from the railroads. By the concentration of ample equipment for carrying on the larger jobs in the maintenance of way department, such as rail laying, ditching, ballasting and raising track out of face, the deficiencies of present day labor can largely be overcome and it will also be possible to concentrate a number of small gangs from a considerable territory. Thus, by instituting the practice of overhauling the track when new rail is laid, the use and concentration of labor saving equipment makes for the greatest economy and results in better workmanship. By concentrating on the larger projects, greater efficiency and supervision can be secured, more and larger units of equipment can be used and, in the end, all of the economies which result from such concentration can be obtained. This also permits making a comparison between the performance of different men and organizations and the devising of means of obtaining still better work and greater economies.

In connection with the above, it is well to call attention to the fact that the standardization of the tools and the equipment to be used is of considerable importance. This is particularly true of the sizes of wheels, axles, and bearings on the different smaller items of equipment used, particularly motor cars.

Labor Saving Equipment Stimulates a Desire for Better Workmanship

One remarkable result that has accrued to the railroads by the reason of the concentrated use of work equipment is the enthusiasm for better performances that has been aroused among the supervisory officers. It is the general practice of the railroads using this method to bring supervisors and foremen from other districts, who will have similar work to perform at a later time, to witness the operations. The spirit of rivalry thus created is highly constructive. Where it is the practice to compute the cost of these jobs and distribute this information among the men, marked reductions have been effected in the cost of the work. Where this is done it is necessary that complete reports be made of the cost of various operations and that these figures be set out in such a way that the average track foreman can see how his performance compares with that of his neighbor.

On lines of heavy traffic the necessity for concentrating equipment in order to perform the largest amount of work within a given length of time, is becoming more apparent to all. The practice of operating a group of four ditchers in one work train and the practice of unloading, laying and picking up rail on the same day are examples of activities which bring large economies to the operating department as well as to the maintenance of way department. The progressive transportation officer generally recognizes that it is better to give up a section of a main track on a multiple track line for a period of from a part of one day up to two days than it is to have work trains interfering with his traffic for several weeks. Thus, by concentrating forces and equipment, material savings accrue not only to the maintenance of way department but to the operating department as well.

The cooperation of the operating department is absolutely necessary in order to obtain maximum results. On the other hand, the obligation rests on the maintenance of way officer to make such a performance that his savings can be clearly shown to the operating officer to offset the necessary increases in expenses which the operating department must incur. Where the work is undertaken with the proper enthusiasm and is properly organized, it is generally the experience that the enthusiasm of the operating officer is equal to that of the man directly in charge of the work.

Using the Pneumatic Tamper to Break Up Snow and Ice

Working with Free Use of Track

Ditching on the Southern Pacific in Texas

Shall Small Scale or Mass Production Prevail in Maintenance?

The Lesson From Other Industries Indicates That Much Can Be Gained From Standardization of Methods

By J. D. KEILEY

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TRACK maintenance is performed by thousands of small gangs ranging in size from a foreman and a few men up to seldom over twelve men. These small gangs, deployed over great stretches of track and away from close systematized supervision, are similar in many respects to the small shops of a century ago. Time and progress have gradually eliminated these small shops. In their place have arisen great factories with compact, highly centralized control of methods.

Efficiency in production, or quantity production, is a matter of methods. The study of methods and their analysis into elements, has come to be a science. Centralized control, with the proper application of correct methods, has increased production far beyond the wildest dreams of the manufacturers of even 50 years ago. Not only has production increased, but the physical energy expended by the worker (or the amount of fatigue) has decreased.

The small shop of 100 years ago was run by a master craftsman who employed possibly a half dozen men. The article manufactured was also made by his competitors. It was virtually the same article. The methods used in production differed among the various manufacturers. Needless to say, the production costs of some were vastly higher than of others. This was due mainly to the methods used. Gradually those with the biggest production costs were eliminated by the invincible economic factor—competition. Gradually there evolved the present day factories where methods have become subject to the closest possible scrutiny and study.

In the study of methods, the importance of the fatigue factor has become apparent. Efficient methods tend to increase production while lessening the fatigue or physical exertion of the worker. This development is, of course, closely connected with various types and kinds of machinery and labor saving devices.

Man has no innate instinct with which to devise methods for doing a given piece of work in the least possible time with the minimum physical exertion. The average man either imitates some one else or does it the first way that comes to his mind and continues with no thought of improvement. This was the case with the average small shop or master craftsman of a century ago.

Section Gangs Resemble Small Shops of Last Generation

Section gangs are similar to the small shop of the past in charge of the master craftsman, but they cannot be consolidated under one roof and subject to the close scrutiny and supervision of the factory. The impossibility of consolidating them under one roof, and other variable factors, such as nature's elements, weather, etc., make impossible the absolute planning of the work and the sending of it through rigid channels as is done in factory production. But to a great extent production methods, similar to factory production methods, can be employed. This is, of course, contrary to the current belief of many practical trackmen. The section gang has one feature which the small shops of the past lacked, and that is all important—they are responsible to one head and, therefore, can be readily brought under centralized supervision and control.

Track maintenance is accomplished by units of small scale production. These units of work can be put in a relatively small category. Maintenance work resolves itself into the endless repetition of these unit operations of work, such as tie renewals, laying rail, ditching, tightening bolts, etc. Each force endeavors to accomplish the same results, but the methods are different and that is where the loss occurs. This loss runs into many millions of man hours a year for the railroads of the country.

Section formen of most railroads receive a haphazard sort of education in track maintenance. Usually it is received entirely from practical experience. There have been practically no careful, scientific studies on the part of the railroads themselves, as to the proper methods to be pursued or the time required for the performance of each type of work.

An individual cannot make a comprehensive study of this character. To do so requires a well equipped organization. An organization or department of this character would save its cost many times over in the saving of man hours. Like many other things, it receives no attention because the results do not show immediate reflection on the balance sheet.

"Hustling" Not Necessarily Efficiency

The fact that the section foreman is handling one of the most elusive elements in any business, namely—man hours, would seem to entitle him to education in the way to handle his men so as to get the maximum efficiency. There is relatively little check by the supervisory officer of the amount of work performed for a given number of man hours. The foreman receives quick rebuke for the waste of material; but if he has his force "hustling" he will not get "called down" for a waste of man hours. To receive reprimand for waste of man hours, the foreman must himself be glaringly lazy and inefficient. To any one who has ever done any "clocking," it is evident that the man who makes the most motion and exhibits the greatest physical exertion is not necessarily producing the largest amount of productive work. The mere fact that a foreman is "pushing" his men does not necessarily prove that the methods by which he is accom-

plishing given results is the method by which he can accomplish maximum production in the minimum time. Each type of track work, from tie removals to ditching, can readily be distributed into their various elements if properly studied.

It is evident that there are many variations in the methods or ways of different foremen for doing the same kind of work. Some of the elements in these various methods, if not in many cases the entire method, are bound by every practical law of logic to be consuming unnecessary man hours for the work accomplished. The old adage that there are half a dozen ways which are "just as good" is pure "bunk." There is usually only one way of accomplishing correctly a given piece or type of work with the minimum man hours, as well as with the minimum fatigue to the men actually performing the work. Needess to say, where this occurs, there is a great monetary loss to the company, even though it does not show up glaringly. As labor costs increase, the loss through inefficient methods increases the monetary loss to the company.

A supervisor of track or a roadmaster, as well as the "higher ups" may know "about" when a foreman is producing a fair amount of work. If the foreman keeps his men hustling and yet apparently does not accomplish as much work as the foreman in an adjoining section, it is usually passed over and excused on the basis that he has harder conditions to contend with—for instance, drainage. In reality, the conditions may be easier, but his methods incorrect. And the only way to find this is to make a close analysis of his methods and check them against a standard "time" and "method."

The nonchalant "about" costs the railroads of the country a sizable sum each year. The supervisors or other supervisory officers are in no way to blame for this condition as they have neither the means nor the opportunity of studying and standardizing methods. The wide deployment of forces and the magnitude of the maintenance of way problem mean there is only one way to attack the "method" problem and that is by a research department—for the want of a better name, we will call it a "Standardization of Methods department."

Remedy Lies in Standardization of Methods

The first step to be taken as a means of diminishing the man hour loss is the standardization of methods. This standardization must be accomplished by exhaustive unit time studies of existing methods. Methods must be thoroughly broken up into their elements, and a complete comparison made by elements. It is highly probable that the proper combination of elements existing in various present methods will produce the ideal method.

These studies can be made most profitably only with the most hearty co-operation on the part of the foreman and the supervisors. Such co-operation can be gained readily as nine foremen out of every ten are very much interested in how the "other fellow does it." The very fact that you arouse discussion and interest will make the foreman become more alert and more eager for better performance.

Eventually, as standard methods of production are put into effect, a concise and complete control and check as to efficiency will evolve and this will be statistical. The value of the human element, the human equation, is great, but its influence on production has been overvalued. It is a nice high sounding phrase, the variable *x*, or "cover all" for inefficiency. The absolute facts of production are the ones which count on the balance sheet. These facts of production can only be reflected and controlled by statistics. Statistics in this case are only of value for comparison with a standard.

Comparisons are only of value where like methods are used to obtain like results. Like methods are synonymous with unit time. Unit time studies, standardization of methods and their correct application mean the diminution of man hour loss. Diminution of man hour loss means increased efficiency. Increased efficiency means money saved.

We Use Small Scale Methods

At the risk of repetition, I desire to emphasize the fact that track maintenance today is large scale production with small scale methods. It is possible, practical and desirable from every standpoint, and particularly from that of the economic conversion of man hours, to put up to date scientific large scale production methods into use. These methods can be used because all maintenance of way forces can be controlled by one head. Their work is precisely the same for like forces, and they are performed at regular recurring intervals.

In the installation of "scientific management," there should be no great influx of "grand new ideas" of performing the various functions of maintenance. It should be based on proven methods of accomplishing work, the planning of the work and its proper dispatching.

The methods of performing different types of maintenance (renewing ties, laying rail, etc.); would be recorded as to their entirety, and then the operations would be analyzed and broken up into their various components. Time studies would be made in detail and by elements so that thorough analyses and comparisons could be made. Then through a very careful, practical and mature process of elimination the "ideal" method, or the so-called "standard method" would be evolved. The knowledge now possessed individually and gained haphazardly would be placed in the proper category, scientifically arranged in the form of permanent records and time studies. The time studies, which would necessarily, to be of any value, have to be very exhaustive and detailed, would be the scientific basis on which the standard methods would be based. These time studies, expresed in units of man hours, man minutes or man seconds, would give costs of various work when applied to the current rate of wages. Being expressed in the time unit will eliminate any difficulty from changes in rates of wages. The standard methods, when derived, would take precedence over all other methods.

There is no human or super-human means of standardizing certain variables such as weather, train movements, or other fluctuating non-controllable factors. All that is claimed for this production basis of maintenance is that, by the standardization of the methods involved in performing maintenance work under general average conditions, each type or unit quantity of work should require an average definitely known time, measured in man hours, to accomplish. In order to attain this, the method by which each unit quantity of work can be accomplished must be recorded and incorporated into instructions.

How to Establish This Standard

Briefly, the first requirement to bring about the standardization of methods is the centralization of all pertinent knowledge. The basis upon which the standard method would be effected rests on absolute comparisons of the various methods now in use. This requires exhaustive field time studies. In conjunction with the field studies a uniform system of daily reporting by section foremen is necessary. The degree of detail of these daily reports depends on local conditions, and the

use to which they are to be put. Consideration should also be given to the planning and dispatching of the work by the section forces.

The general survey would first require the compilation of all types of work performed by the average section force. The following is a general idea of some of the various kinds of work a section force has to perform:

Unloading gravel	Cubic yards
Unloading stone	Cubic yards
Unloading cinders	Cubic yards
Ballast cleaning	Cubic yards
Skeletonizing track, gravel	Feet of track
Skeletonizing track, stone	Feet of track
Skeletonizing track, cinder	Feet of track
Bank widening	Lineal feet and width
Surfacing track, 3 in.	Lineal feet and width
Surfacing track, 6 in., first lift	Lineal feet and width
Surfacing track, 6 in., second lift	Lineal feet and width
Installing ties	Number and feet of track
Removing old rail	Number and feet of track
Gaging track	Number feet
Unloading and distributing rail	Number feet
Unloading and distributing ties	Number
Unloading and distributing tie plates	Number
Unloading and distributing rail anchors, anglebars, bolts, spikes, etc.	Number
Spiking rail	Number feet of track
Applying tie plates	Number feet of track
Applying rail anchors	Number feet of track
Applying fastenings	Number feet of track
Renewing ties	Number feet of track
Renewing switch ties	Number or sets
Turnout installations	Number or sets
Piling old ties	Number
Lining and spotting	Feet of track
Cleaning ballast	Feet of track
Spacing ties	Number and feet of track
Tamping ballast	Feet of track and number of ties
Cleaning stations	Name, etc.
Policing track	Miles
Cutting right-of-way	Lineal feet
Tightening bolts	Feet of rail

Studies of climatic conditions with respect to their variation between districts and divisions, and with attention to ranges of temperature and the length of the period in each year in which maintenance work can be done and carried on will show at times, for example, that in certain territories tie renewals as well as rail laying can be done throughout the year. In such cases it would probably be better to perform work of this character late in the fall and early spring as the weather is cool and the men do more work than in the extreme heat of July and August.

The Data Should Originate with the Foreman

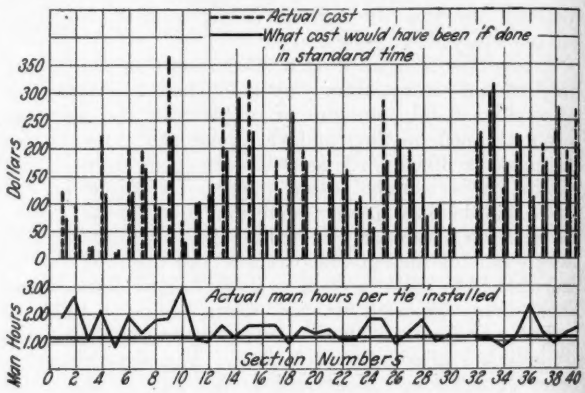
Most, if not all, of the reports should orginate with the man who actually uses the material and has direct supervision over the man hours in applying the material. This is the section foreman. Immediately there is apt to arise the protest that a section foreman is not a clerk and if he were capable of being one he would not be a section foreman. However, it is by means of a daily system of reporting that the greatest steps will be made in standardizing methods.

A uniform, comprehensive system of daily reports by section foremen is essential. These reports would include the amounts and kinds of materials used day by day and the number of men and the hours consumed in applying them. These reports would also be used for accounting purposes. A running analysis and comparative charts by sections should be kept by weeks or months, as desired, these charts being compiled from the daily reports or summaries, which would also indicate the effectiveness of the planning and dispatching of the work.

The unit of comparison is the man hour. All operations are capable of a relative comparison by the use of man hours. Knowing what a definite piece of work costs is valuable for the present but it is worthless for the future unless the rates of wages remain the same. By the use of man hour statistics it is a simple matter to ascertain the costs at any rate of pay. Time—the man hour is the common element present in the performance of every job. Wasted material usually has salvage value; the wasted man hour is lost forever.

An example of a running analysis of a tie renewal study is shown in the chart. The basis of the study is the man hours per tie renewed. It is assumed that the standard performance has been established tentatively by actual field time studies to be 1.1 man hours per tie. That represents good performance for the purpose of this discussion.

In most cases, a force, when putting in ties, does nothing else for the eight-hour period. This work consists



The Cost of Tie Renewals Shown Graphically

The graph or curve on the lower half represents the average actual man-hours per tie for each section for all ties installed in a month. This is secured by taking the average for the entire month, and represents fairly accurately the amount of work accomplished by the given section force—or its efficiency in tie renewals. The line drawn at 1.1 man-hours represents what it should take. The sections that fall below this line are doing good work, while those above are not doing good work, unless they are limited by local conditions.

The graph or curve on the upper half of the sheet represents the actual cost, as shown in red, to make all the tie renewals for each section for the month. The black shows what it should have cost, using 1.1 man-hours per tie as the basis.

of (1) Removing old ballast, (2) pulling spikes, (3) pulling out old ties, (4) inserting new ties, (5) spiking new ties, (6) tamping new ties, (7) forking ballast, and (8) piling old ties preparatory to burning or inspection.

Each foreman's method varies to some extent from that of his associates. On some days work goes slowly and on others faster. But for a period of 30 days and for adjoining sections which have the same traffic and other conditions and ballast, there should be no wide variation. In order to obtain the cost of tie installation, it is only necesary to multiply the hourly rate of pay per man by the man hours per tie. The chart is self explanatory.

Is there any question as to the tremendous savings that can be effected by the proper use of this kind of information? The man supervising this work makes an effort to save material from being wasted, but he does not usually realize the value of the man hour, which, once gone and paid for, can never be recovered. Increased production per man, will be the result of getting men to think in terms of man hour.

How the Illinois Central Uses Labor More Efficiently

Detailed Programs, Concentration on Specific Tasks and Analysis of Methods Increase Output

By G. M. O'Fourke,
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THE INCREASED interest which the railways are showing in the economical utilization of their labor is a gratifying indication of the trend toward more efficient maintenance. The railroads have long delayed the inclusive and progressive programming of their maintenance of way work, but they are now beginning to see the value of such measures. There is no question but that the vast programs for maintenance of way work must be handled in a more systematic manner. Too long, through lack of progressiveness or procrastination, the roads have delayed that systematic planning which has transformed thousands of tottering business enterprises into sound concerns.

This is a big job that has been long classed with the theoretical, but it is now becoming the subject of much study. Through the committees of the American Railway Engineering Association hundreds of reports and time studies on maintenance of way operations have been received from various railroads. Some of these reports have shown merely a good beginning, while others have manifested established systems that have stood the test and have proved of great value.

How Section Work Was Scheduled

The Illinois Central has had a part in this work, which it intends to continue. The change which has been brought about on a Class B district that in the past has always been a good example of the results of unsystematic endeavor by the introduction of an applied system and program of work has been most outstanding. Prior to its introduction things did not go smoothly. The supervisor could not keep track of the situation. Surfacing, tie and rail renewals and other work had been done, here, there and elsewhere with regard only to the local conditions. The situation was unsatisfactory from the standpoint of the section foreman on up, all because of the lack of systematic program.

Early in 1923 the district engineer and the division road master set out to remedy the situation. Starting at the beginning of the territory they motored and walked over the line in company with the supervisor. Every condition that arose was discussed thoroughly with the section foreman to enlist his interest. The situation was analyzed and his solution solicited. He was told that it was the plan to overhaul his district, and keep it up to standard in a systematic manner. He was asked where the logical starting place on his section was.

A plan was mapped out which involved the surfacing of certain stretches of track. The number of tie renewals and the amount of additional ballast required were determined, as well as the amount of rail to be relaid. The question of man-hours and allowance then arose, as it does necessarily in every case.

The manner in which this quantity was determined and the success secured have proved most interesting. With the beginning of 1922 the Illinois Central adopted a policy of making records whereby units of measure could be established for performing maintenance of way work. The plan required that each foreman enter daily on a special monthly form the amount of each class of work done during the day and the man-hours consumed in doing each task. This involved considerable work on the whole, but little individuality. There were those who opposed the plan but it was carried on. There were inaccuracies, no doubt, which weakened its defense, but the vast volume of data accumulated, when summarized, reduced these inaccuracies to small importance, and the value of the work is unquestioned.

The following are the operations reported at the present time:

1—Spotting ties in rock and cementing gravel ballast.
2—Spotting ties in bank run, washed gravel and cinders.
3—Spotting in ties while surfacing.
4—Putting in switch ties in rock and cementing gravel ballast.
5—Putting in switch ties in bank run, washed gravel and cinders.
6—Surfacing track in rock and cementing gravel ballast.
7—Surfacing track in bank run gravel ballast.
8—Surfacing track in washed gravel and cinders.
9—Dressing track in rock and cementing gravel ballast.
10—Dressing track in bank run gravel ballast.

11—Dressing track in washed gravel and cinders.
12—Unloading and distributing rail and fastenings.
13—Laying new rail.
14—Laying second hand rail.
15—Uncoupling old rail.
16—Loading old rail and fastenings.
17—Relaying turnouts.
18—Applying rail anchors.
19—Applying tie plates.
20—Cleaning weeds from tracks.
21—Mowing right of way.
22—Unloading ties.
23—Unloading gravel ballast.
24—Unloading cinders.
25—General repairs.

A weekly report, simple in form, is also required of each foreman, in which he shows the number of rail lengths of track surfaced and remaining to be surfaced to complete his program; the number of cross ties applied and yet to be applied; the number of switch ties applied and to be applied; and the number of man-hours consumed on the program work during the week. Rail lengths of track were adopted as units for simplicity in recording surfacing and dressing track. The supervisor summarizes these reports and grades the foremen according to accomplishments to date, sending a copy of the summary to each foreman for the purpose of arousing competitive interest, and a copy to the division road master. It has been found that keeping the foremen thus advised of the progress on neighboring sections maintains interest.

It was realized that one year of such reports is not sufficient, so the work went on in 1923, during which time interest increased steadily, and we are now confident of the greater accuracy of the reports. The plan is now being carried on in 1924, and while weather conditions have caused diversified and interrupted operation, forcing the recording of the greater part of the results in the column under general repairs, the season will soon open with its steady work suitable to accurate tabulation.

In this manner we have acquired and will continue to collect data on which we can rely in allotting man-hours for specific work. As the necessity arises, new operations, or similar operations variously performed, will be added to the work under record, and in this manner we will keep up to date.

In handling his work, each foreman is instructed that when he begins his program of surfacing and tie renewals, he must work without interruption for the number of consecutive days that local conditions will allow. This continuous application is a very important factor in successful maintenance. On sections where many spots of soft roadbed develop it is not expected that the gangs can devote as much time continuously to face work as on other sections where the number of "soft spots" is not so great.

In the past, in order to permit uninterrupted work, permission has been secured from the superintendent to reduce the speed of trains over the places that became rough until the time fixed for such repairs came. On some sections the men could work without interruption for five days consecutively, while on others it was necessary for them to devote two and sometimes three days to repairs.

Another Method of Making Time Studies

There is another method of making time studies of maintenance of way work on the Illinois Central which is proving very effective. This method is in accord with the recommendations of the American Railway Engineering Association, adopted at the 23rd annual convention on March 14, 1922, which method, although carried out only through the year 1923, has proved its worth. We have not only derived benefit in the way of planning maintenance of way work, but, to a much greater extent, by using this method to determine the relative efficiency of mechanically assisted and hand work. This method has also been applied with success in determining the most economical gang organizations.

A man from the engineering department, with an interest in and a realization of the importance of the report to be made, is detailed to make the investigation. Making his headquarters in the vicinity of the work, where conditions necessitate or warrant, he is the first on the job and the last to leave. He records the following general information, aside from the detailed records made which are explained later: Date, location, weather conditions, temperature, all special conditions that pertain to the work at hand, the names of the section foremen and the number of their men, the running time to and from the scene of the work, the time spent in preparation for actual work, all delays, avoidable or unavoidable, the time taken for dinner, the quitting time for each gang, the leaving time, etc.

In each study one of the primary objects is to ascertain the man-hours required, exclusive of delays, to perform a unit measure of work most economically. In relaying rail this unit is ten 33-ft. rail lengths. In renewing cross ties one tie renewed is the unit, in cleaning ballast one cubic yard of ballast. Similar appropriate units are used for other items of work.

As an example, in relaying rail, each operation from the time the first operation is started, based on ten rail lengths, is timed, the number of men involved is noted and the man-minutes computed. Each distinct operation is repeatedly so timed, exclusive of any delays, and preferably not in succession, until it is felt of a certainty that an authentic average for each operation can be established. As a result of this we have the tabulated average output in man-minutes for each operation in relaying rail, based on the unit adopted. A summary of these averages, plus the time computed for foremen, gives the average output in man-minutes for the complete relaying of ten rails. This figure, converted into man-hours, is designated as Standard Schedule Speed.

During the process of making the unit tests on each operation, the original organization and any shifts thereof which were made were noted, as well as any special conditions and difficulties. In fact, all matters pertinent to an accurate investigation have been taken note of.

It is readily understood how results obtained in this manner, ofttimes requiring a week or more of actual observation, are of much value. Adjusting the results of these studies, in order to absorb varying conditions, gives definite ground for allotting man-hours, and the making of recommendations as to the methods of carrying out the work.

One of the tests conducted in the above manner on relaying rail showed that the job was started with the wrong gang organization, and that a 40.3 per cent increase in man-hours resulted in an increase of 96.8 per cent in the amount of rail relaid. A similar increase in output was realized by the reorganization of gangs on certain machines. While the results obtained in 1923 do not warrant the publication of results as a finality, we are convinced that these methods of measuring the output of labor and machines in the maintenance of way and structures department and the application of the units of measure determined, have proved of great value to the Illinois Central and can be applied with like success by other roads.

Railroad Painting Calls for the Employment of Many Men.

Mechanical Painting Saves Labor

What May Be Expected of Good Equipment and the Essentials for Success in Its Intelligent Use

By C. C. FREDRICKS,
Vice-President and General Manager, W. N. Matthews Corporation, St. Louis, Mo.

THE extensive use of mechanical painting equipment is the immediate solution of the labor shortage problem in painting. A painting machine in the hands of a trained operator will enable him to do as much painting on most surfaces as 3 to 10 men using the bristle brush. However, it is not thought by those who know mechanical painting that it will eliminate the use of the bristle brush, for more brushes will be used than ever, considering the increase of painting which is bound to come. The brush is essential for the painting of sash, for the trim, when the color is different from the body and for many other details on all work.

There are those who will say that mechanical painting is not practicable for building painting. The answer to that is—it has been and is being done every day. Again, there are men who will say that mechanical painting is fine for large, unbroken surfaces such as warehouses, shops, office buildings, etc., but not for the average run of small buildings. The answer again is that while surprising speed and economy of time and labor show up spectacularly on large surface work, that is not the limit of usefulness of mechanical painting equipment by any means, for houses are being painted outside with the usual oil paints and inside with flat wall paints, oil paints and water paints. Success and much economy and convenience attend the work. Mechanical painting equipment has been time-tested and proven; the pioneering work is done.

It is said that anyone can, without experience, do any kind of painting with equipment which involves no more than an insignificant investment of money.

These are pure fabrications of imagination. Mechanical painting is not divorced from the rules essential to good general painting. It will not bring about any immediate revolution in general painting practices; it will not make possible those things which are mechanically impossible; it is not fool proof; it does not change paints and their characteristics; it does not change surfaces and their peculiar individual requirement for protection. decoration, better illumination or sanitation.

What Kind of Mechanical Equipment Will Paint

Painting machines capable of doing satisfactory painting are made by skillful engineering organizations having the experience to build this mechanical device to meet a wide range of conditions. Cheap machines cannot be depended upon for successful painting. The high class mechanical painting outfits are guaranteed to perform in a satisfactory manner what is claimed for them.

With the introduction of every new machine to save the labor of human hands a certain amount of readjustment, planning and change in management must be considered a part of the new order of things to gain the full benefits of the new machine. Little difficulties arise calling for ingenuity, but the reward for overcoming these is worthy of the effort.

Until a mechanic has been convinced that a machine is a good thing for him and everyone, he will not want to see it succeed. When he hopes it will fail he leaves undone the little duties which are essential to the correct operation of the machine. So, the first place to begin when any new machine is introduced is with the minds of the men who will operate that machine. Convince them, as you are convinced, and they will want to see the machine succeed. Then it will.

What the Mechanical Painter Must Know

Quite as essential as capable mechanical painting equipment is the ability of the men who operate it. Before a man can reasonably expect to succeed in painting buildings mechanically he ought first to be a good manual painter. A knowledge of various woods and the characteristics of all surfaces to be coated is essential. It is

more important that the surface be judged correctly in order to be sure that the first coat on a new building will dry comparatively flat. The machine painter must know materials and the mixing of paint and colors.

To get the most out of mechanical painting equipment is no job for the indifferent or careless workman. It is much easier to apply paint to form a uniform thickness of film with it, than when using the bristle brush, but in the hands of the thoughtles workman the paint may be put on too thick. In that way much material can be wasted. Study, practice, experience—all are essential to the proper handling of mechanical painting equipment. But this postgraduate course pays handsomely in the high quality and the greater quantity of work done.

What Materials May Be Applied Mechanically

Mechanical painting equipment may now be had which will apply any paint, varnish enamel or water paints which are of proper consistency for application with the bristle brush. It is not necessary to have paints especially prepared for mechanical application. To assure complete success in their passage through the painting equipment for building painting, materials ought to be maintained at a uniform composition. Pigments ought to be fine and the thinners should remain the same. With such materials painters are able quickly and easily to adjust the materials to surface requirements and to apply them with maximum efficiency.

The painter cannot, of course, add turpentine to prepared paints to reduce the gloss, because too much thinner destroys the opacity of the paint. It may be that the best way to supply prepared paint for mechanical application would be the delivery of a first coat mixture made to dry flat and the finishing coat mixture as now made. The latest types of mechanical painting equipment will handle materials of all consistencies successfully; probably paint weighing about 14 to 16 lb. per gal. is about right. The greater the weight of the paint used the more pressure is needed, but the air pressure is easy to regulate. It ranges from 15 to 90 lb. per sq. in., depending upon the consistency of the material. Likewise the up-to-date equipment will handle all kinds of painting materials—outside paints, ready mixed paints, white lead painter-mixed paints, zinc paints, red lead, graphites, mineral oxides, enamels, flat wall paints, water paints, stains and varnishes.

The Durability of Mechanically Applied Paints

The proper mechanical application of paints and other decorative and protective materials does not change their characteristics in the least. So the durability expected is exactly that of the materials used, just as it would be if the application were made with the bristle brush, with something in favor of the mechanically applied paint because of the greater uniformity of the thickness of the film.

The idea held so tenaciously by old time painters—that paint must be put on thick and rubbed out thin with the brush, that much "elbow grease" must be expended—is not now considered of any importance when applied mechanically by skilled painters. Good paints are as durable on metal as on wood; it is, of course, impossible to force paint into the metal surface as it was thought to be brushed into the pores of the wood. The driving force of air pressure behind paint is quite equal to any amount of brush rubbing, if that were necessary. The durability resulting from good brush work probably is due largely to securing a uniformly thick paint film by much brushing.

Air propelled paint, properly atomized and controlled, fills every crack and crevice and hole against rain, wind and frost or snow. That must add to the durability of the paint so applied by keeping out the moisture which causes scaling.

Mechanically Painted Surfaces Have Good Appearance

The perfect control of the volume of paint issuing from the material gun by the finger and trigger, the control of the thickness of the paint film by moving the hand—these two factors assure a better appearing paint job, because a more uniform coating must result. The rough and porous places are easily filled up level to look like the whole surface; a coat of uniform thickness is spread over the whole area. There are no brush marks to disfigure enamel and varnish-coated surfaces, or flat wall paint coatings. For very fine varnish and enamel work no pitted or stippled appearance will be noted if free flowing and self leveling varnishes or enamels are used.

A superior appearance is assured with mechanical painting for another reason. The painter cannot get away with indifferent mixing. He must judge his surface accurately and then mix the paint exactly right with a first coat to dry nearly flat. Otherwise his last coat will run, sag and wrinkle. He must mix thoroughly and strain his paint with exceptional care, or it may clog the gun nozzle. He should weigh his materials for mixing. In many ways he must do a better job than when the paint is applied with the bristle brush.

How Many Coats Are Needed?

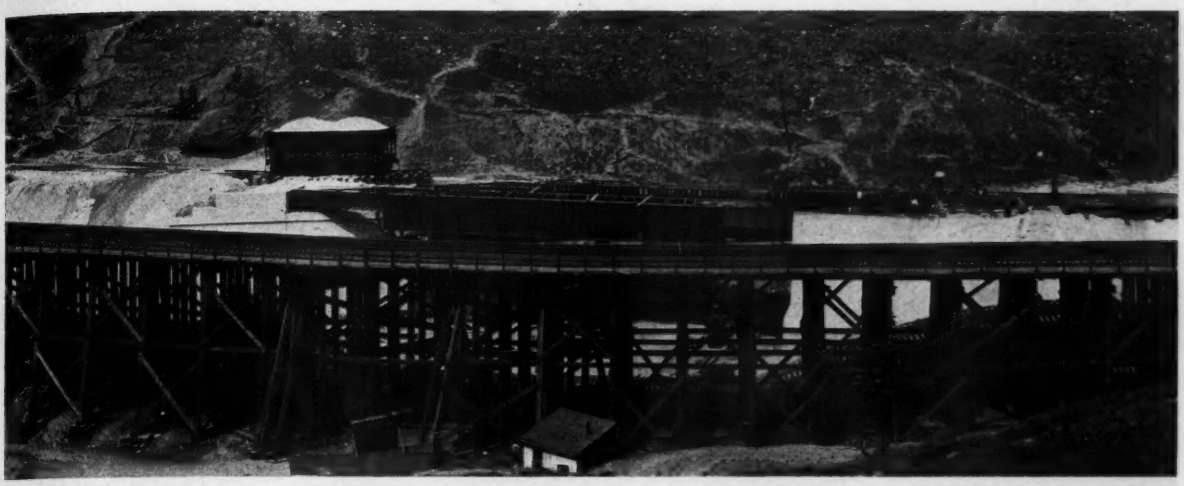
Mechanical painting is no exception to the rule in good painting which has few exceptions, namely, that two thin coats are more durable and satisfactory than one thick coat. In mechanical painting only enough paint is put on to hide the surface and cover it uniformly.

Practically all surfaces that are now being covered with a bristle brush can be coated mechanically, and the absence of the brush marks is a considerable advantage on many kinds of surfaces. On rough surfaces such as cement, stucco, rough plaster, brick, tile, shingles, beaded ceiling and rough sawn siding boards, the mechanical painting equipment works with a huge saving in time and labor and also saves the excessive wear and expense for bristle brushes. Large, uninterrupted ceiling and wall areas are painted mechanically in much less time than is required for doing them with the bristle brush in the ordinary way.

A considerable saving of time and labor cost is gained on much mechanically painted work because many one and two story buildings may be painted entirely from ladders, only the cornice and high surfaces requiring planks on ladder brackets. With the mechanical painting equipment it is not necessary to get as near any surface. An extension handle is made which enables a man to reach many surfaces and paint them from a distance. The interiors of many large office and shop rooms are painted, ceiling and all, without the use of scaffolds, ladders and planks.

The most valuable machine ever put into service will do poor work if the operator wishes it to do so. Painting machinery is no more of an exception than the best bristle brush ever made in the hands of an indifferent or careless workman.

If the painter doesn't mix his paint and colors thoroughly; if he does not strain it with care; if he does not take a steady pace in swinging the gun to direct the paint on the surface uniformly a poor job will likely result. But charge that to the man, not the machine. Such a man would probably do poor work with any kind of tools.



The Detour Trestle Complete—New Steel Bridge, Partially Completed, in the Background.

Baltimore & Ohio Builds Detour Trestle to Aid Bridge Renewal

Construction of Temporary Timber Structure Simplifies Problem—Later Dismantled and Reclaimed

By P. G. Lang, Jr.
Engineer of Bridges, Baltimore & Ohio

IN ORDER to effect a needed bridge renewal at Pittsburgh, Pa., under difficult conditions, the Baltimore & Ohio recently constructed a temporary trestle over which traffic was detoured. This was designed so that the material could be reclaimed with practically no loss and again used in the construction of other work of a similar nature. By its use a difficult condition was easily overcome while because of the freedom permitted by the rerouting of traffic, it was possible to secure low construction costs on the new bridge.

The Baltimore & Ohio enters Pittsburgh along the valley of the Monongahela river. The main line to the west diverges at Laughlin Junction, about three miles east of the Pittsburgh train shed, and proceeds in a northwesterly direction, crossing the Allegheny river on the line of Thirty-third street, and connecting with the western portion of the system at Millvale, Pa.

A wye is located at Laughlin Junction, one branch of which leads across a narrow valley about 2,000 ft. west of the junction. The center of this valley is occupied by Boundary street. The original bridge at this point was a double-track iron viaduct, consisting of nine deck plate girder spans ranging in length from 30 to 56 ft. supported on eight iron bents and two masonry abutments. The total length of this structure was 319 ft., 3 in.

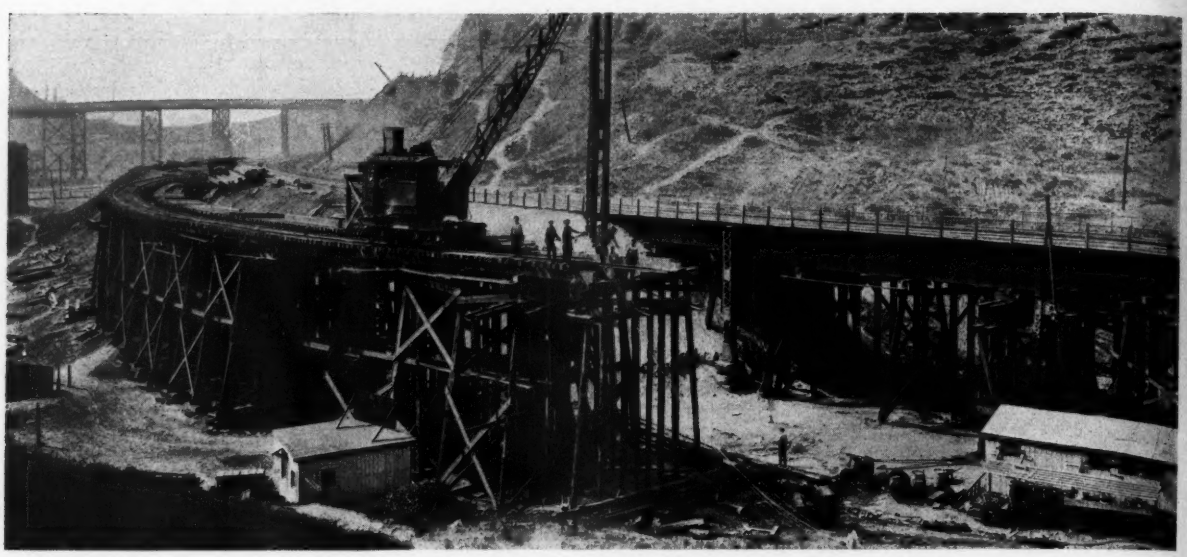
With the rapid increase in the weight of motive power, the bridge became inadequate for the locomotives in service and in order to operate a certain classes of heavy modern engines, it was necessary to relieve the old viaduct with timber bents. It will be noted from one of the illustrations that the area beneath the old structure was almost entirely occupied by the original iron bents and the timber relieving bents subsequently placed.

The same photograph also shows a new slag fill at the east end of the bridge. This fill became necessary on account of a slide which started on the adjacent hillside, and was placed for the purpose of protecting the track, preserving line and surface and maintaining the bridge.

The new bridge spans a street 50 ft. wide between building lines, consisting of a 30 ft. roadway and two 10 ft. sidewalks. The crossing is made on a skew of 25 deg. 22. min. The new structure is composed of three spans of double track deck plate girders supported on two new concrete abutments and two steel bents footing on concrete pedestals. The necessity of maintaining traffic, the type of the old viaduct, the numerous relieving bents installed, the slide and the new slag fill, which was located at the place where one new abutment was to be built rendered it practically impossible to build the new structure under traffic.

Careful investigation of the character of foundation to be secured, the nature and extent of the slide, and all surrounding conditions, together with a thorough consideration of the feasibility of supporting tracks and building the new structure under traffic, in comparison with the use of a detour trestle, led to a decision in favor of the latter procedure.

This construction of the detour trestle was undertaken with the distinct understanding that the material would be salvaged and re-used later. One of the illustrations shows the completed detour trestle, and also gives a distant view of the new bridge approaching completion. Another view shows the new bridge at an advanced stage of completion, and clearly indicates the extreme skew of the crossing and the type of abutments. It also gives another view of the detour trestle. In the distance is



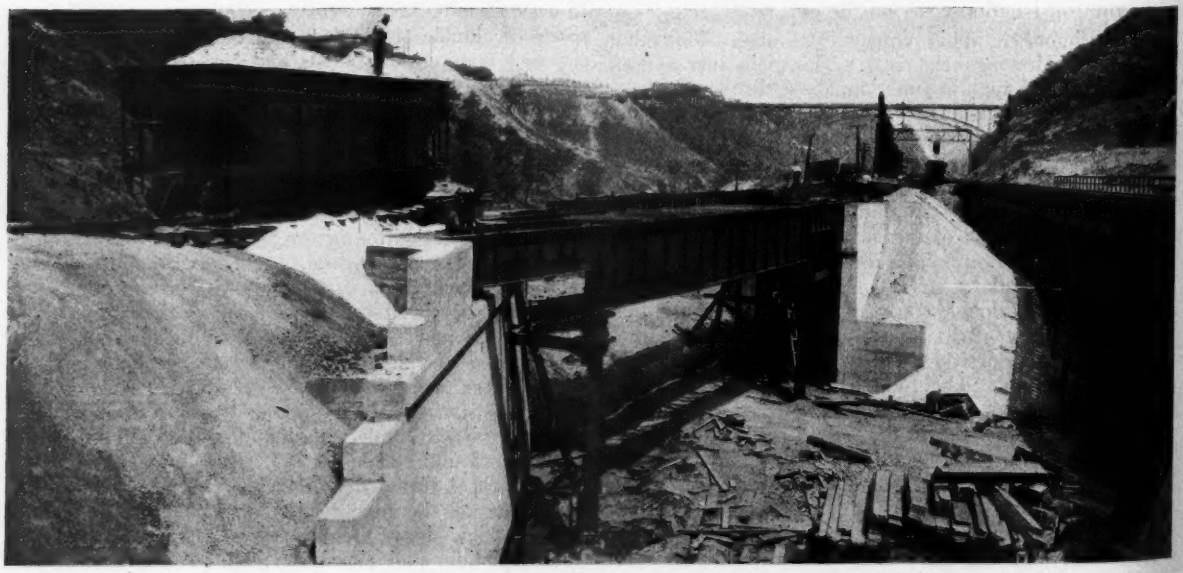
The New Detour Trestle in Process of Construction

shown the overhead arch bridge carrying a highway in the vicinity of Schenley Park, Pittsburgh.

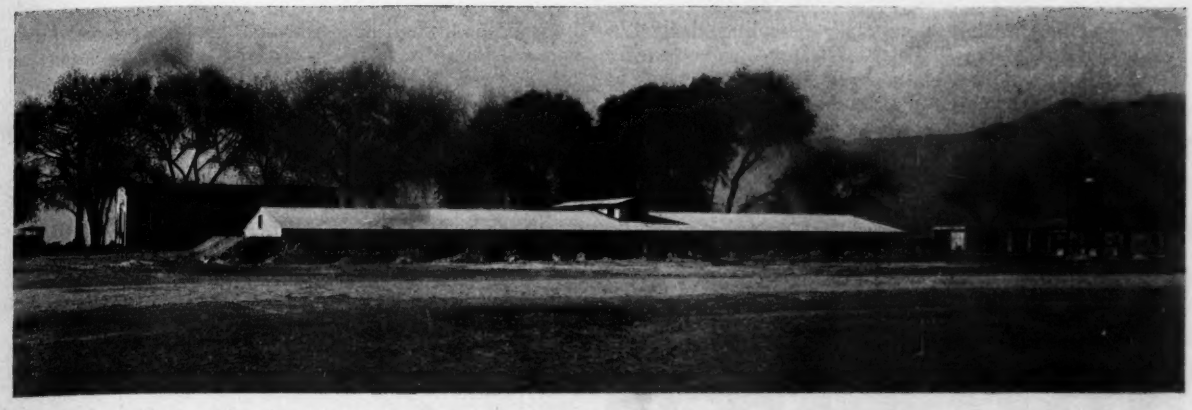
The traffic at this point, which is very heavy and frequent, was taken care of in a thoroughly satisfactory manner by this method, which permitted the new structure to be built well to one side, thus avoiding interference with the operated line and providing excellent working space for the contractor's plant and equipment engaged in the construction of the new bridge. The procedure which was adopted embodied the further advantage of reducing the construction costs of the new sub-structure and superstructure materially below those which would have been incurred if an attempt had been made to build the new stucture under traffic.

One contract was let covering the removal of the old iron viaduct and timber relieving bents, the construction of the double-track detour trestle, the necessary excavation, and the construction of the new concrete abutments and pedestals. The railroad company furnished all material for the double-track detour trestle. The erection and painting of the new steel bridge, the framing and placing of the floor timber and the removal of the double track detour trestle after the completion of the new bridge and the restoration of traffic to the permanent line were covered by another contract.

The detour trestle has now been entirely removed, and all of the material used in its construction has been salvaged and assigned to use in other work of a similar character. Each section of this detour trestle was carefully unbolted and taken apart, and the use of mauls and other heavy implements which might tend to mutilate the timber and render it unsuitable for re-use was carefully avoided, the general object of this work being to salvage each piece in sound, undamaged condition. To insure the attainment of this object, the representatives of the railroad company exercised special vigilance during the dismantling, which insured the contractor's compliance with the terms and intent of the specification.



The New Steel Bridge Approaching Completion—Note Extreme Skew of Crossing



The Southern Pacific's New Pumping Plant at El Paso, Tex.

Southern Pacific Completes Million Gallon Pumping Plant

Large Air Lift System at El Paso Proves Big Improvement Over Prior Arrangement

ONE of the most interesting recent developments in railway water service is a new pumping plant at El Paso, Tex., which the Southern Pacific has completed. Internal combustion engines of 50 hp. are not unusual in pumping service but it is the exceptional case where 200 hp. units are employed as at El Paso. There are many wells in the country which go down as far as 800 ft. or more but it is not often that railroads draw 1,000,000 gal. a day from such a source. Operated by an air lift and located on a mesa five miles from El Paso, the new station marks the culmination of an extended effort to remedy a very troublesome and expensive water supply problem.

Old Supply Insufficient and Expensive

Previous to the present installation, the Southern Pacific's water supply facilities at El Paso consisted of six, eight-inch wells having an average depth of 350 ft. Each of these wells contained a five-inch column pipe with a 4¾ in. working barrel and a 6 in. Cook well screen, operated by a No. 32 Downie double-stroke geared pumping head over each well, driven by a 15 hp. Fairbanks-Morse type NB gasoline engine. The water was discharged into two 48,000 gal. cypress tanks. This plant was very expensive in operation and maintenance. It required a large amount of attendance and the wells were continually giving trouble, due to sanding of the strainers. Furthermore, the total output of the entire plant was only slightly over 100,000 gal. per day while the consumption at El Paso rarely fell below 700,000 gal. daily. This made it necessary to obtain the bulk of the water required at El Paso from the city at a cost of 20 cents per 1,000 gal. while the water secured from the wells, in spite of operating troubles, cost from 12 to 15 cents per 1,000 gal.

The situation was one requiring careful investigation. Added to the problem was the discovery of a variation in the quality of water in the region under consideration for the new development. It was discovered that the water strata on the mesa to the north and east of El Paso generally contained water of good quality at all levels, but that all wells located within the city limits below the level of the mesa and to the south and west of Mount Franklin must have the top strata cased off as these upper waters carry salt from the Rio Grande valley.

New Wells 870 Ft. Deep

The outcome of the efforts to improve the supply at El Paso was the drilling of two wells, one 863 ft. deep and the other 869 ft. deep, cutting all the water bearing strata. These wells are cased from top to bottom with

The Water Is Discharged Into Receivers with Umbrella Tops

12-in. standard line pipe casing, the entire lower 600 ft. of which is slotted. These slots are each ¼ in. wide and 14 in. long and are arranged in 13 rows, there being 150 slots per joint of pipe. The slots in alternate are staggered and the distance between the slots in each row is seven inches, the result of which is to make seven rows of 12 slots each and six rows of 11 slots each in each joint.

The water bearing strata are sand and gravel occurring between alternate layers of clay, varying anywhere from five to 30 ft. in depth. The water drains from the Sacra-

mento and San Andres mountains, extending about 125 miles northward from El Paso. The total water bearing strata amounted to 280 ft., the static head of which is 213 ft. below the surface of the ground. By intensive pumping natural screens were formed in the wells as a result of removing the sand and allowing the gravel to settle around the casing. The success of this development has been such that little sanding has occurred in the wells

The Interior of Pump House Showing Air Compressors in Foreground and Oil Engines in Background

since they were put in operation. Each well has a capacity of 750 gal. per min. with a nine foot drawdown; one of the wells normally delivering 731 gal. per min. under an operating pressure at the well of 96 lb. while the other delivers 659 gal. per min. under a pressure at the well of 95 lb.

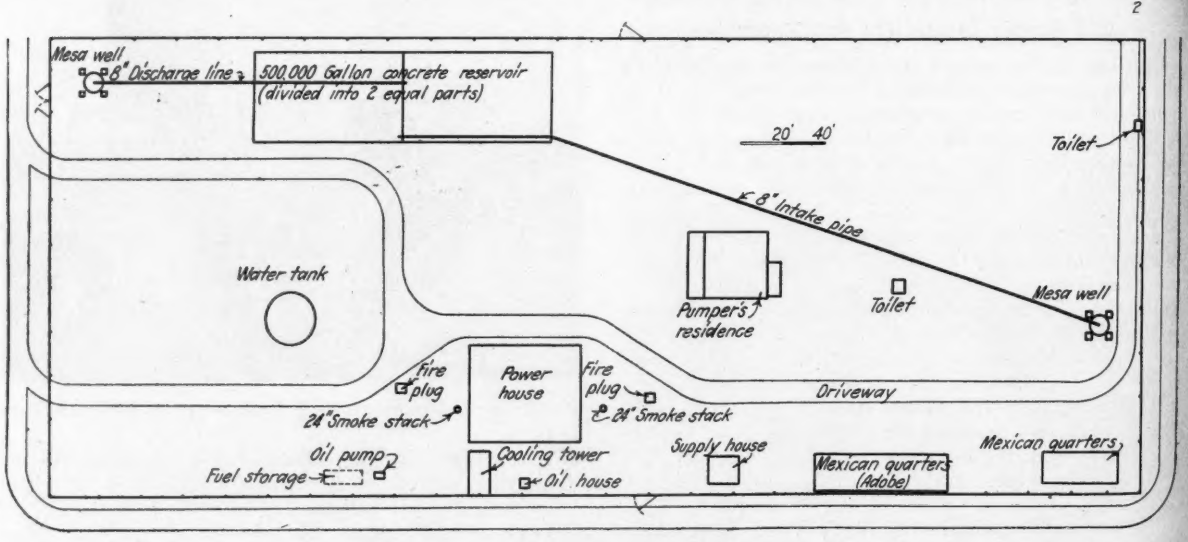
The wells are located about 200 ft. apart. The air reaches the wells from the compressor through a four-inch line while a 2½-in line delivers the air from the top of the well to the footpiece. The education pipe in each well is eight inches in diameter and extends to a point 850 ft. from the surface. The water is discharged into a receiver with an umbrella well top and thence goes by gravity through an eight-inch line to a reservoir. In each case the receiver consists of a steel tank 6 ft. in dia. and 6 ft. high, supported immediately above the well on a four-post steel tower carried on concrete footings. This tower provides a ladder to afford access to the top of the receiver.

The reservoir is situated about midway between the two wells. It is a concrete structure built about half below and half above the ground and consists of two chambers, each 40 ft. wide, 70 ft. long and 12 ft. deep, providing a capacity of 240 gal. each. Each chamber is equipped with baffle walls and they are so related that one chamber may be drained and cleaned while the other is in service. When undergoing cleaning, the sand is sluiced out through a 10-in. drain line. The reservoir is covered with a slightly pitched gable roof of corrugated iron, supported on frame trusses. A monitor roof across the center assists in providing ventilation. The shops, yard and other facilities at El Paso are supplied directly from this reservoir through an eight-inch cast iron line 21,000 ft. long which produces a pressure at the shop gage of 70 lb.

Power Plant Includes 200 HP. Engine in Duplicate

The power plant is directly opposite the reservoir at a distance of about 100 ft. and consists of two Fairbanks-Morse type Y, four-cylinder vertical oil engines having 200 hp. rating each and developing 174 hp. at 257 r. p. m. at 3,800 ft. elevation above sea level. These engines operate on 24-30 gravity distilate or parafin base fuel, consuming 0.5 lb. of fuel per hp. hour. The starting system for these engines consists of two direct-connected six hp. Fairbanks-Morse type Z engines and 3¾ in. by 4 in. compressors supplying 150 lb. starting pressure, the air being contained in four cylinders and the units operating on kerosene oil.

Two Sullivan angle compound class WB3 air compressors produce the compressed air for pumping the water. These compressors are belt-driven from the gas engines. They are being operated at a speed of 190 r. p. m., at which each well gets about 960 cu. ft. of free air per min. The normal rating of the compressors being 1214 cu. ft. per min. at 240 r. p. m., a considerable margin of capacity is thus afforded. The cooling system for the power units and the compressors consists of two belt-driven two-inch



The Layout of the Mesa Pumping Plant

volute centrifugal pumps operating at 1,500 r. p. m. These pumps circulate the water from the engine and compressor jacket through a cooling tower located outside the power house.

The power plant also includes a 6 in. by 4 in. by 6 in. Worthington duplex steam pump which is operated by air. This supplies water to an auxiliary 50,000 gal. tank situated on a tower at the rear of the power plant which is kept filled with water for general use around the plant and particularly for fire protection. For the latter purpose the pump is so connected as to by-pass direct pressure to fire plugs. An underground tank of 13,500 gal. capacity provides storage for the fuel oil.

Power Plant Attractively Arranged

All the machinery is neatly arranged in a commodious house of corrugated iron. This house is 44 ft. wide and 56 ft. long and has a gable roof supported on frame

A Close-Up View of the 200 Hp. Oil Engines

trusses and covered with Brooks three-ply asbestos roofing. The building is exceptionally well lighted by large windows on all sides and looks very attractive both inside and out with its concrete floor and concrete foundations for each of the power units, together with the architectural treatment of the exterior. Unlike the usual pumphouse the exhaust from the engines is not carried directly through the wall but is muffled through concrete pits in the house, from which it is carried to 24 in. smokestacks located outside of the house. A fire plug is enclosed in a box at about 50 ft. from each end of the house for fire protection purposes, while night lighting is provided by electric globes hung from conduits strung on the ceilings. The grounds are well graded and are shaded by a large cluster of spreading trees. Included in the facilities is a commodious dwelling for the pumper as well as quarters for other workmen.

While only recently completed, the new facility has fulfilled expectations and constitutes a big improvement over the system by which the Southern Pacific has been obtaining its water. Troubles from sanding together with the annoyance incident to the old installation have been eliminated and the cost of the water has been greatly reduced. At the present time the water consumption averages 1,000,000 gal. a day, which supply is maintained by an average 12 hour pumping shift.

The development and construction of the new facility has been carried on under the direction of H. M. Lull, chief engineer, Southern Pacific lines, with J. W. Harshaw, division engineer, in charge, to whom we are indebted for the description of the work.

Promoting Efficiency by Combining Section Gangs

By A. J. Neafie
Principal Assistant Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

THE PROBLEM of track maintenance by small section gangs has received a great deal of thought from maintenance officers of all railroads and has always led to the use of extra gangs in locations where, for one reason or another, the tracks needed a general overhauling. About fifteen years ago the roadway department of the Delaware, Lackawanna and Western adopted what is known as Section Equated Mileage, whereby the unit cost for the different classes of work required in maintaining any section of roadway were reduced from cost records covering a long period to a unit basis of the cost to maintain a mile of main track, as well as the man allowance for an equated mile of track for summer and winter seasons

The equated cost per mile of track maintenance has lead the maintenance officers to believe that greater efficiency can be obtained from the men so employed, by placing one foreman in charge of a double section. The organization of the double section gangs is limited by the present equated cost per mile for track maintenance, which includes all work performed by section and extra gangs and should consist of a high class foreman, a sub-foreman and the same number of men as is now allowed the two regular sections which are to be combined to form the double section. For example, two regular sections gangs are allowed, on the equated mileage basis, a foreman and 10 men each; the double section will be allowed a foreman, a sub-foreman and twenty men.

Such an arrangement will be advantageous to the foremen for the reason, that they will receive compensation in excess of that which is now paid extra gang foremen, and to the sub-foremen for the reason that it will afford the opportunity for them to learn from first-class foremen, become familiar with all kinds of section work, and eventually be able to take a foreman's position, in charge of a double section and gang. It is apparent from the above that the railroad will show a saving in the cost of supervision of the double section gang, over the cost of supervision of regular section gangs. It is believed that many other savings will result from this arrangement.

The use of motor cars on sections has removed any objection which maintenance officers have had concerning the reasonable lengthening of sections as it is now possible for section gangs to go to any portion of a double section in a relatively shorter time than when hand-cars were used on short sections. Therefore, it is possible to concentrate section labor in camps and in larger gangs and eliminate one foreman.

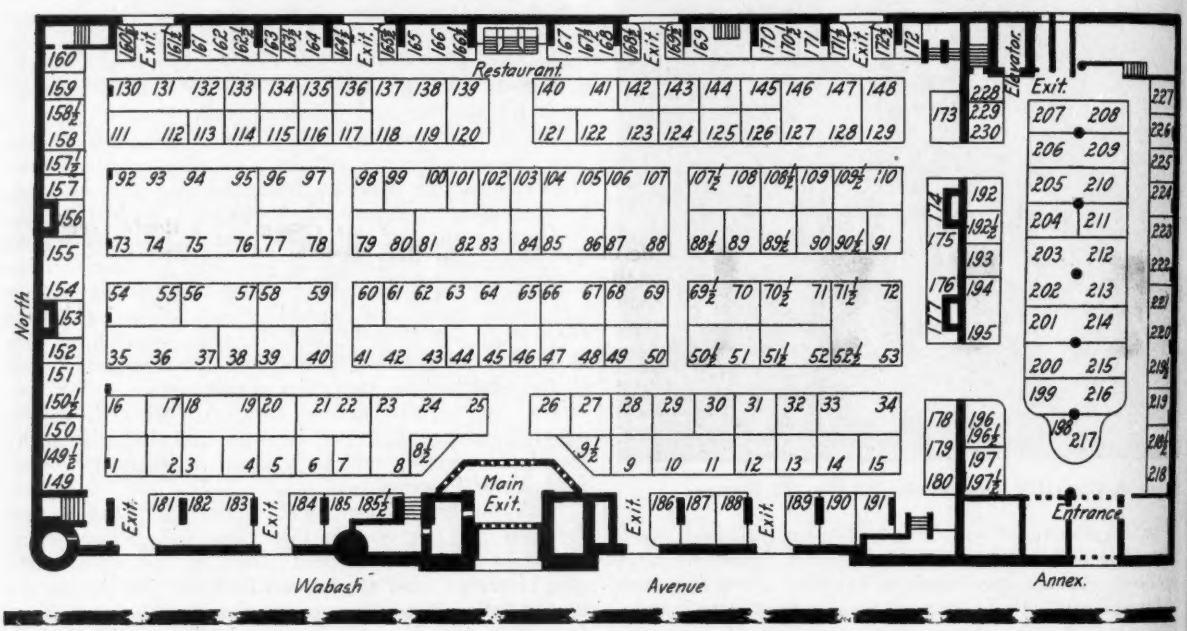
It is believed that the foremen's efficiency will be increased by paying a higher rate of wage, that the concentration of labor in large gangs will materially increase the amount of work performed by the gang

over that performed by two small gangs. Further the elimination of one gang will be economical as the larger gang, having a sub-foreman, can, with a few men, take care of the small jobs usually handled by the small section gangs and supervised by the foreman which has always been an expensive method. It is also believed that a saving in clerical work will be effected by one man reporting instead of two and that the elimination of one-half of the gangs will reduce the flagging locations on account of track raising, etc. and train detentions to a minimum, which is an important item which does not usually show in the accounts.

Manufacturers Preparing Annual Exhibit

SPACE has been allotted to 163 firms engaged in the manufacture and sale of railway equipment and supplies for the sixteenth annual exhibit of the National Railway Appliances Association. This is the same number as exhibited last year. As in past years, this exhibit will be held in the Coliseum, Chicago, during the week of the annual conventions of the American Railway Engineering Association and the Signal section of the American Railway Association. The Coliseum will be open during the mornings and afternoons from Monday, March 10, to Thursday, March 13, inclusive, and also on Tuesday evening, March 11. This exhibit has become such a well known institution, with such thoroughly established standards as to the exhibits displayed, that further explanation as to its character is entirely unnecessary.

A list of exhibitors, together with a floor plan of the Coliseum, showing the space to be occupied by each exhibitor, is given below:



Exhibiting Members

Adams & Westlake Co., Chicago, booths 87, 88, 106 and 107.
Adams Motor & Manufacturing Co., Chicago, booths 218 and 218½.
Ahlberg Bearing Co., Chicago, booth 169.
Air Reduction Sales Co., New York City, booths 167, 167½ and 168.
American Abrasive Metals Co., Chicago, booth 153.
American Bolt Corporation, Chicago, booth 1.
American Car & Foundry Co., Chicago, booth 125.
American Chain Co., Bridgeport, Conn., booths 81, 82 and 83.
American Hoist & Derrick Co., St. Paul, Minn., both 88½.
American Malleable Castings Association, Cleveland, Ohio, booths 181, 182 and 183.
American Steel & Wire Co., Chicago, booths 33 and 34.
American Valve & Meter Co., Cincinnati, Ohio, booths 130, 131 and 132.
Anchor Co., Milwaukee, Wis., booth 164½.
Argyle Railway Supply Co., Chicago, booth 163.
Armco Culvert & Flume Manufacturers' Association, Middletown, Ohio, booths 99 and 100.

Baker, R. & L., Co., The, Cleveland, Ohio, booths 205 and 210.
Balkwill Mangenese Crossing Co., Cleveland, Ohio, booths 201 and 214.
Bethlehem Steel Co., Bethlehem, Pa., booths 52½, 53, 71½ and 72.
Blake Manufacturing Co., Mansfield, Pa., booth 224.
Blaw-Knox Co., Pittsburgh, Pa., booth 89.
Bowser & Co., S. F., Inc., Fort Wayne, Ind., booth 9.
Brach Manufacturing Co., L. S., Newark, N. J., booth 2.
Brown Rail Loader Co., Boston, Mass., booths 229 and 230.
Bryant Zinc Co., Chicago, booths 154 and 155.
Buda Co., The, Harvey, Ill., booths 61, 62, 63, 64 and 65.
Butler Manufacturing Co., Kansas City, Mo., booth 189.

Carbic Manufacturing Co., Duluth, Minn., booths 165, 166 and 166½.
Carnegie Steel Co., Pittsburgh, Pa., booths 51½ and 52.
Carter Bloxonend Flooring Co., Kansas City, Mo., booth 219.
Central Electric Co, Chicago, booth 17.
Challenge Company, Batavia, Ill., booth 109.
Channon Company, H., Chicago, booth 144.
Chicago Bridge & Iron Works, Chicago, booths 50½ and 51.
Chicago Malleable Castings Co., Chicago, booth 142.
Chicago Pneumatic Tool Co., New York City, booths 118, 119, 137, 138 and 142.
Chicago Railway Signal & Supply Co., Chicago, booth 7.
Chipman Chemical Engineering Co., New York City, booth 45.
Cities Service Oil Company, Chicago, booth 4.
Clark Car Company, Pittsburgh, Pa., booth 115.
Cleveland Frog & Crossing Co., Cleveland, Ohio, booth 90½.
Cleveland Railway Supply Co., Cleveland, Ohio, booth 133.

Copper Weld Steel Co., Rankin, Pa.
Creepcheck Co., The, Inc., Hoboken, N. J., booth 157½.
Crerar, Adams & Co., Chicago, booth 28.

Detroit Graphite Co., Detroit, Mich., booths 58 and 59.
Diamond State Fibre Co., Bridgeport, Pa., booth 116.
Dickinson, Paul, Inc., Chicago, booth 98.
Dilworth, Porter & Co., Pittsburgh, Pa., booth 27.
Duff Manufacturing Co., Pittsburgh, Pa., booth 89½.

Edison, Thos. A., Inc., Bloomfield, N. J., booths 18 and 19.
Electric Storage Battery Co., Philadelphia, Pa., booth 40.
Electric Tamper & Equipment Co., Chicago, booths 149 and 149½.
Elwell-Parker Electric Co., New York City, booths 200 and 215.

Fairbanks, Morse & Co., Chicago, booths 73, 74, 75, 76, 92, 93, 94 and 95.
Fairmont Railway Motors, Inc., Fairmont, Minn., booths 41, 42 and 43.
Fleming & Son Co., J. R., Scranton, Pa., booth 172½.
Frog, Switch & Manufacturing Co., Carlisle, Pa., booths 47 and 48.

General Electric Co., Schenectady, N. Y., booths 35, 36 and 37.
General Railway Signal Co., Rochester, N. Y., booths 49 and 50.
Graver Corporation, Chicago, booths 96 and 97.
Gurley, W. & L. E., Troy, N. Y., booth 60.

Hall Switch & Signal Co., Garwood, N. J., booths 85 and 86.
Hayes Track Appliance Co., Richmond, Ind., booths 140 and 141.
Hazard Manufacturing Co., Chicago, booths 21 and 22.
Headley Good Roads Co., Philadelphia, Pa., booths 158 and 158½.
Howlett Construction Co., Moline, Ill., booth 186.
Hubbard & Co., Pittsburgh, Pa., booth 143.
Hoffman Manufacturing Co., The A., Chicago, booth 169½.

Idol Track Liner Co., Chicago, booth 225.
Illinois Malleable Iron Co., Chicago, booth 5.
Illinois Steel Co., Chicago, booths 70½ and 71.
Ingersoll-Rand Co., New York City, booths 206 and 209.
International Signal Co., New York City, booth 135.

Jaeger Machine Co., Columbus, Ohio, booth 31.
Johns-Manville, Inc., New York City, booths 174, 175, 176 and 177.
Jordan Co., O. F., East Chicago, Ind., booths 56and 57.

Kalamazoo Railway Supply Co., Kalamazoo, Mich., booths 8, 23, 24 and 25.
Kaustine Company, Inc., Reading, Pa., booths 163½ and 164.
Kelly-Derby Company, Inc., Chicago, booth 30.
Kentucky Rock Asphalt Co., Louisville, Ky., booth 157.
Kerite Insulated Wire & Cable Co., Inc., New York City, booths 68 and 69.
Keystone Grinder & Mfg. Co., Pittsburgh, Pa., booth 193.
Keystone Steel & Wire Co., Peoria, Ill., booth 211.

Layne-Bowler Chicago Co., Chicago, booth 188.
Lehon Company, The, Chicago, booth 91.
Lorain Steel Company, The, Johnstown, Pa., booths 202, 203, 212 and 213.
Lufkin Rule Co., The, Saginaw, Mich., booth 121.
Lundie Engineering Corp., The, New York City, booth 90.

McGraw-Hill Co., Inc., New York City, booth 8½.
MacRae's Blue Book Co., Chicago, booth 9½.
Magnetic Signal Co., Los Angeles, Cal., booth 165½.
Maintenance Equipment Co., Chicago, booths 194 and 195.
Massey Concrete Products Corporation, Chicago, booths 54 and 55.
Mechanical Manufacturing Co., Chicago, booths 219½, 220 and 221.
Mercury Manufacturing Co., Chicago, booth 227.
Metal & Thermit Corp., New York City, booths 207 and 208.
Metal Safety Railway Tie Co., Philadelphia, Pa., booth 161½.
Miller Train Control Corporation, Danville, Ill., booths 197 and 197½.
Morden Frog & Crossing Works, Chicago, booths 69½ and 70.
Mudge & Co., Chicago, booths 127, 128, 146 and 147.
Murdock Manufacturing & Suppy Co., Cincinnati, Ohio, booth 134.
M. W. Supply Co., Philadelphia, Pa., booth 101.

National Boiler Washing Co., Chicago, booth 12.
National Carbon Co., Inc., Cleveland, Ohio, booths 150½ and 151.
National Lead Co., New York City, booth 114.
National Lock Washer Co., The, Newark, N. J., booth 192.
National Malleable Castings Co., Cleveland, Ohio, booth 102.
National Safety Appliance Co., The, Chicago, booth 150.
National Vulcanized Fibre Co., Pittsburgh, Pa., booth 126.
Nelson, B. F., Manufacturing Co., Minneapolis, Minn.
Nichols & Bros., Geo. P., Chicago, booth 173.
Northwestern Motor Co., Eau Claire, Wis., booths 196 and 196½.

Ogle Construction Co., Chicago, booth 29.
Ohio Brass Co., The, Mansfield, Ohio, booth 3.
Okonite Company, The, Passaic, N. J., booth 16.
Oxweld Railroad Service Co., The, Chicago, booths 10 and 11.

Page Steel & Wire Co., Bridgeport, Conn., booth 84.
Patterson Co., W. W., Pittsburgh, Pa., booth 145.
P. & M. Company, The, Chicago, booths 122 and 123.
Pittsburg-Des Moines Steel Co., Pittsburgh, Pa., booth 152.
Pocket List of Railroad Officials, The, New York City, booth 26.
Portland Cement Association, Chicago, booth 117.
Positive Rail Anchor Co., Marion, Ind., booths 178, 179 and 180.
Pyle-National Co., The, Chicago, booth 190.

Q. & C. Co., The, New York City, booths 120 and 139.

Rail Joint Co., The, New York City, booths 79 and 80.
Railroad Accessories Corporation, New York City, booth 13.
Railroad Supply Co., The, Chicago, booths 104 and 105.
Railway Purchases & Stores, Chicago, booth 159.
Railway Review, Chicago, booth 44.
Ramapo-Ajax Corporation, Hillburn, N. Y., booths 109½ and 110.
Rawls Machine & Manufacturing Co., Chicago, booths 161, 162 and 162½.
Reade Manufacturing Co., Jersey City, N. J., booth 187.
Reliance Manufacturing Co., The, Massillon, Ohio, booth 108½.
Richards-Wilcox Manufacturing Co., Aurora, Ill., booths 170, 170½ and 171.
Roberts Co., Geo. J., The, Dayton, Ohio, booth 136.
Roberts & Schaefer Co., Chicago, booth 14.
Robertson & Co., Wm., Chicago, booth 184.

Sellers Manufacturing Co., Chicago, booth 124.
Sherwin-Williams Co., The, Cleveland, Ohio, booth 15.
Signal Accessories Corp., Utica, N. Y., booth 113.
Simmons-Boardman Publishing Co., New York City, booth 46.
Snow Construction Co., T. W., Chicago, booths 107½ and 108.
Southern Signal Co., Louisville, Ky., booth 6.

Templeton-Kenly & Co., Ltd., Chicago, booth 32.
Torchweld Equipment Co., Chicago, booth 156.
Track Specialties Co., Inc., New York City, booth 39.

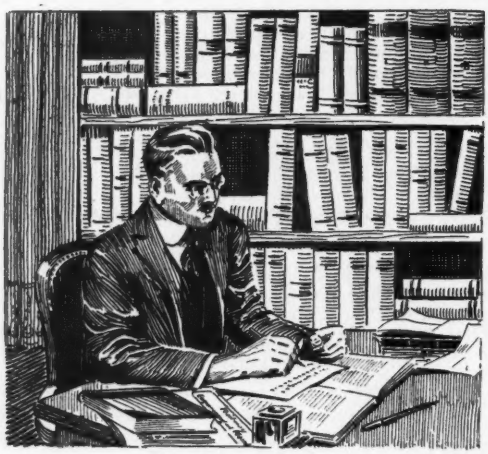
Union Switch & Signal Co., Swissvale, Pa., booths 66 and 67.
U. S. Wind Engine & Pump Co., Batavia, Ill., booths 111 and 112.

Van Dresar, E. L., St. Paul, Minn., booth 168½.
Verona Tool Works, Pittsburgh, Pa., booths 129 and 148.
Volkhardt Co., Inc., Staten Island, N. Y., booth 160.

Warren Tool & Forge Co., The, Warren, Ohio, booths 222 and 223.
Waterbury Battery Co., The, New York City, booth 38.
West Disinfecting Co., New York City, booth 171½.
Western Electric Co., Inc., Chicago, booth 20.
Western Wheeled Scraper Co., Aurora, Ill., booth 191.
Westinghouse Electric & Manufacturing Co., East Pittsburg, Pa., booths 77 and 78.
Wharton, Jr., & Co., William, Inc., Easton, Pa., booths 199 and 216.
Wood Shovel & Tool Co., The, Piqua, Ohio, booth 226.
Woolery Machine Co., Minneapolis, Minn., booth 204.
Wright Manufacturing Co., Lisbon, Ohio, booth 192½.
Wyoming Shovel Works, The, Wyoming, Pa., booth 103.

Yale & Towne Manufacturing Co., The, Stamford, Conn., booth 228.

What's the Answer?



This department is an open forum for the discussion of practical problems of maintenance of way and structures. Readers are urged to send in any questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. *Railway Engineering and Maintenance* also solicits the co-operation of its readers in answering questions.

Questions to Be Answered in the May Issue

1. What is the best method of locating and determining the extent of obstructions in water supply lines?

2. Should track be resurfaced when rail is relaid and if so, how closely should this follow the rail laying?

3. What is the best way of anchoring a crib wall in an embankment?

4. Can tie renewals be made most economically by the regular section gangs or by extra gangs?

5. Is the quality of water used in making concrete of importance and, if so, what impurities should be guarded against?

6. What measures, if any, is it practicable to put into effect to prevent the promiscuous dumping of locomotive cinders along the track, thus fouling the ballast?

7. What supervision should be exercised to insure that camp cars for floating gangs are maintained in proper condition?

8. To what extent should carpenters be expected to provide their own equipment and tools?

The Allowable Shimming of Bridges

What is the maximum amount of shimming which may safely be done when surfacing trestle bridges?

First Answer

It is the practice on the Nashville, Chattanooga & St. Louis, ordinarily, to limit the height of shimming in trestle bridges to two inches. Where shimming of greater height than two inches is required, plank of the full width of the cap and of such thickness as necessary is substituted.

The established rules on this road with respect to blocks and shims require that they must be closely watched. They must be sound and not split. Only one shim or block is to be used in one place, never two or more on top of one another. Spikes, nails or other fastenings for shims and blocks must be driven near the corners and never into the center. Holes must be bored for spikes and bolts in all blocks over two inches thick and all shims and blocks must be long enough to give room for fastenings. HUNTER MCDONALD,

Chief Engineer, Nashville, Chattanooga & St. Louis, Nashville, Tenn.

Second Answer

Timber trestle bridges consisting of pile bents, frame bents on pile stubs or mud sills will settle more or less, depending a good deal on the character of the soil and the driving of the piles. Where slow settlement has occurred the usual practice is to place thin shims, one on top of another. In such cases the maximum thickness of these shims should not be over one inch, and where such shims are required they should be securely spiked to keep them from working out, splitting or crushing, which occurs frequently due to vibration and further settlement. When the maximum thickness has been reached the thin shims should all be taken out and replaced with one thick shim.

Frequently it is found that shims have been driven under each stringer from both sides of the cap. The practice should not be allowed except for temporary repairs when proper lumber is not available, and when a shim is necessary it should be the full width of the cap. In cases where one or two of the intermediate piles have settled, it is necessary to place the shims between the top of the pile and the bottom of the cap. These shims should be made of one thickness, placed with a groove in the center to miss the drift bolt and long enough so that they can be securely spiked to the bottom of the cap. If further settlement occurs the shim should be taken out and replaced with a thicker shim.

F. H. CRAMER,

Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago.

Third Answer

Where the speed on a trestle is slow and the track is on a tangent, bridges can be shimmed on top of the pile bents as high as four feet above the caps by driving bolts through the shims and the caps to hold them firmly together. Where the traffic is fast and heavy and the track is on sharp curves or where there is a possibility of sudden applications of brakes while passing over such structures, it is not desirable to shim more than two feet above the caps. This shimming should be done with good, sound, firm timber, firmly bolted through the stringer, shims and caps, and the bents thoroughly braced.

In ordinary maintenance of trestles I consider it perfectly safe to shim up to 12 in., a little at a time, using

small shims. Then it is necessary to raise the stringers higher, the small shims should be taken out and replaced by full size timber up to 12 in. If necessary to shim beyond that, the small shims may again be used.

Trestles in which the caps are level can be maintained safely with the shims higher than structures where the bent has settled more on one side than the other; especially if the settlement is more on the outer side of a curve, the centrifugal force of the trains tending to push the shims down hill. If the settlement of the bent is in the opposite direction, that is, the low side settles more than the high side of the curve, the centrifugal force will, to a large extent, be offset by the slope of the cap and the shims can be carried up higher than in the other case. If the bents settle badly to one side, it is better to cut off the posts or piles and make the cap level and block up on the level cap. If, for any reason, it is necessary to raise stringers above the maximum of these limits, it can be done by placing longitudinal timbers on the bents, under the stringers, and cross-blocking at the panel points. In this way a raise of several feet can be made safely by holding the speed down to a reasonable limit of, say, 12 to 20 miles per hour.

R. H. REID,
Supervisor of Bridges, New York Central, Cleveland, Ohio.

Supplies for Motor Cars

How large a stock of parts and supplies for motor cars should be carried by a foreman?

First Answer

The stock of parts to be carried by a foreman should consist of one extra belt, a good supply of belt lacing, one set of extra batteries, one battery meter, one or two spark plugs and other small accessories which are needed if the car should require repair at some distance from headquarters.

V. J. CASSANO,
Foreman, Great Northern, Summit, Mont.

Second Answer

Since the Western lines of the Great Northern employ a maintainer of motor cars on each division who is equipped with an ample supply of parts and supplies for motor cars, it is not considered necessary for the foremen to keep such supplies on hand.

J. J. HESS,
General Roadmaster, Great Northern, Seattle, Wash.

Third Answer

It is the policy of this company to have foremen carry no motor car repair parts other than such supplies as oil, gas and possibly a spark plug and an old belt to protect against emergencies. If vital parts of any of the cars or engines are needed they can usually be procured by telegraph order from a store point, within 24 hours' time. During the time the motor car is out of service the foreman confines his work to parts of his section near the station or is transported either by hand car or the motor car of one of the neighboring sections.

C. H. ORDAS,
Supervisor of Motor Cars, Chicago, Milwaukee & St. Paul, Chicago.

Fourth Answer

A few foremen are able to make repairs on their cars intelligently. These men might be supplied with a limited stock of such parts as are liable to require replacement, such as timer parts, gaskets, etc. However, where there is an organization for the maintenance of the cars it is not necessary to have any stock of parts whatever on the section and the stock of spark plugs should be limited to two. It is very easy to tie up a considerable amount in repair parts where they are scattered over the road. Moreover, these parts gradually become obsolete.

J. R. WATT,
General Roadmaster, Louisville & Nashville, Louisville, Ky.

Fifth Answer

The foreman should have an extra set of batteries, a few battery connections and extra spark plugs with him for emergencies, together with plenty of grease and lubrication and a few tools necessary to make repairs on the line. Repairs other than this should not be necessary if a foreman examines his car daily and anticipates repairs, as he can telephone to headquarters and receive such repairs on the next train.

G. E. STEWART,
Assistant Engineer, Southern Pacific, Stockton, Cal.

Sixth Answer

A section foreman does not need to carry any parts or supplies for a motor car except a few spark plugs which are needed frequently. All foremen know how to replace spark plugs but very few of them could replace any other part of a car. However, the district supervisor should carry sufficient supplies in stock to replace broken parts promptly and, where necessary, should have one or more relief cars to furnish foremen in case the regular cars become disabled. This will eliminate much lost time on the part of section gangs.

A. BOLOGNESE,
Section Foreman, Philadelphia & Reading, Royersford, Pa.

The Minimum Coverage of Reinforcement

What is the minimum distance that reinforcement should be placed from the surface of concrete to prevent corrosion?

First Answer

The depth of concrete below reinforcement necessary to prevent corrosion varies according to the conditions or type of structure under consideration. Tests have proven that 1½ in. to 2 in. of well mixed concrete will prevent steel from rusting. But there are other features to consider when a greater depth of covering should be provided. The surest protection of steel is to see that the concrete is sufficiently plastic so that it will flow entirely around the reinforcement. If mixed rather dry, stone pockets will form at various points and rusting of the steel is liable to take place.

In many cases when close inspection of the work is not expected, the depth of concrete below the steel should be greater, also consideration should be given to the type of structure. When steel is to be placed near the base of footings, 4 in. to 6 in. should be considered the thickness of covering. For retaining walls 3 to 4 in. of covering is sufficient, under ordinary conditions, and where the wall is to be well drained and the mixing and placing well supervised, 2 to 2½ in. should be considered. For ordinary thin slabs and where moisture is not a factor, one inch is ample protection, but for long span slabs and where the slabs are subject to outside weather conditions, also excessive moisture in building structures, 2½ to 3 in. should be the minimum thickness. For beams, girders and columns the thickness should not be less than 2½ to 3 in.

If subject to severe weather conditions, excessive heat or moisture, less covering of the reinforcement will likely cause corrosion. For small and large piers when the rise and fall of the water varies and the concrete is

subject to frost action, ice and drift, 6 in. should be considered the minimum thickness. F. H. CRAMER, Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago.

Second Answer

The question can well be answered by quoting Sections 66 and 67 from the progress report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, viz.: Section 66:—Metal reinforcement in wall footings and column footings shall have a minimum covering of three inches of concrete. Section 67:—Metal reinforcement in fire resistive construction shall be protected by not less than one inch of concrete in walls and slabs and not less than two inches in beams, girders and columns, providing aggregate showing an expansion not materially greater than that of limestone or trap rock is used; where impractical to obtain aggregate of that grade, the protective covering shall be one inch thicker and shall be reinforced with metal mesh not exceeding three inches in greatest dimensions, placed one inch from the finished surface.

The metal reinforcement in structures containing incombustible materials and in bridges where the fire hazard is limited shall be protected by not less than ¾ in. of concrete in slabs and walls and not less than 1½ in. in beams, girders and columns.

Spalling of Concrete Column

Section 68 allows one-half the thickness of a plaster finish to be considered in computing the thickness of the concrete protection. Section 85 specifies a minimum protection of three inches for reinforcing steel in concrete placed in sea water. All of these distances refer to the net thickness of concrete protection and not to the distance from the center of the steel to the surface of the concrete, which would be somewhat greater.

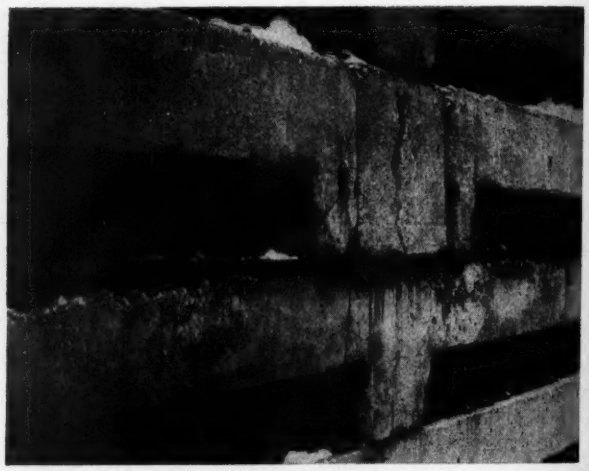
Doubtless, evidence can be produced that smaller coverings have proven satisfactory, and it is probable that if high quality concrete was always secured and if the placing of the steel was always exact, those distances could sometimes be reduced without serious danger. However, the slight saving in cost that could be obtained does not justify the risk of possible corrosion of reinforcing steel and resultant spalling of the concrete. Rust occupies about twice as much space as the steel from which it is corroded, and tests made by the U. S. Bureau of Standards indicate that the bursting pressure exerted by corroding steel on the encasing concrete may be as high as 4700 lbs. per sq. in. Obviously it is necessary to prevent such corrosion.

Evidences of the results of placing steel too close to the surface of concrete are all too plentiful. One of the illustrations shows a concrete column less than eight years old that has spalled badly due to insufficient protection of the reinforcing steel. If the hoops had been placed exactly according to plan, they would have been covered by ½ in. of concrete. Their diameters varied slightly, and they were placed too close to one side of the column. Water penetrated the thin layer of mortar, the steel rusted and the concrete spalled off, as shown in the photograph.

In the precast cribbing shown the same situation existed. Corrosion started at points where the bars were very close to the surface. As the bars were located in the corners, the spalling effect was severe, often exposing an entire bar.

Once started, corrosion progresses rapidly, with resultant spalling of concrete. Merely specifying that reinforcing steel be placed a sufficient distance back of the surface of concrete is not enough, the specification must be enforced.

All reinforcing steel should be located accurately as shown on the plans and should be securely wired in place. The inspector should examine it and give his approval before concreting is started. Often small concrete blocks, precast of the same materials as will be used for the structure, are set in the forms to hold the steel in place while the concrete is being deposited. If wood blocks are used for this purpose they should all be removed before they become buried in the concrete. Spacers and ties should be sufficiently close together to prevent sagging of the steel. It is easily seen how serious a sagging of ⅜ in. or ½ in. becomes when the minimum of ¾ in. of cover is being used.



Concrete Cribbing With Reinforcing Too Close to the Surface

There is a tendency to make certain concrete units, such as bridge railings, of too light section. Often heavier sections could be used without difficulty or without materially increasing the weight or cost. If this feature is considered in the original design, the architectural effect will not be injured, and may even be improved. If it is absolutely necessary to use light sections, special effort should be exerted to secure a high quality, dense, impervious concrete. D. A. TOMLINSON, Manager Railway Department, Portland Cement Association, Chicago.

Placing Brick in Platforms

What are the relative merits of the several patterns to which brick is laid in platforms?

First Answer

We have quite a large number of brick platforms on the Boston & Albany and as far as service goes, I do not think that it makes any difference to what pattern the bricks are laid. The pattern, in my opinion,

is altogether a matter of appearance, although, to obtain a successful brick platform, it should be laid on a concrete foundation.

F. B. FREEMAN,
Chief Engineer, Boston & Albany, Boston, Mass.

Second Answer

Brick 3 in. by 4 in. by 8½ in. will afford maximum service, when laid flat, at right angles with the length of the platform. The joints between the brick should be filled with a proper asphalt filler. (See the book issued by the National Paving Brick Manufacturers' Association's book entitled "The Construction of Vitrified Brick Pavements, including Recommended Specifications.")

The foundation necessary to bring the platform to its proper height may be made with a thoroughly compressed bed of cinders, gravel or broken stone, the subgrade being thoroughly drained. This artificial foundation of cinders, gravel or broken stone should be at least 10 in. in depth where possible. A sand bed, thoroughly and uniformly compacted, is necessary upon which to lay the brick.

If these directions are followed the platform will maintain its level and grade for years without any displacement whatever. The reason for laying the brick flat is that it exposes the rougher texture of the brick to the wear of traffic, affording a sure foothold for the pedestrians, and thus avoiding accidents. A departure from the foregoing may be indulged in, but with little if any saving, and may result either in an unsatisfactory platform or, in the long run, in added expense and perhaps both.

WILL P. BLAIR,
Vice-President, National Paving Brick Manufacturers' Association, Cleveland, Ohio.

Larger Ties at Soft Spots

What advantages, if any, are to be gained by using larger or longer ties at soft spots?

First Answer

Larger ties are to be recommended under track crossings where the weight and constant pounding compress the ordinary tie in a short time. The larger tie, having a greater bearing surface, will make the crossing more rigid. Larger ties are also advantageous under slip switches and at similar special places. They are not to be recommended for soft spaces in open track. The thing to do in such cases is to get at the source of the trouble and remedy the conditions without changing the uniformity of the track ties.

G. E. STEWART,
Assistant Engineer, Southern Pacific, Stockton, Cal.

Second Answer

It has been my observation that the use of long ties at soft spots, while of some benefit, does not give the desired relief. It is better to dig out the soft material to whatever depth it is thought advisable, backfill with material that has considerable carrying capacity, place standard ballast on this material and set standard ties in the ballast. The backfilling increases the area of soft material carrying the load to a much greater extent than can be secured through the use of long ties.

J. R. W. DAVIS,
Engineer Maintenance of Way, Great Northern, St. Paul, Minn.

Third Answer

Swamp ties should be resorted to only after it has been found impossible to avoid their use. Muskegs should be broken down under construction if it is at all possible to secure the material for fill.

Many of the earlier lines could not have been attempted, however, if work of this permanent character had been done and such places were left to the maintenance forces to finish. After several years of traffic and filling the bottom is reached and the use of long ties may be discontinued. This may be done in two or more ways. Often a few rail lengths of the long ties can be released at either end of the swamp used for renewal towards the center, until gradually the entire lot may be replaced with standard ties. Also, renewals of 12 ft. ties can in a few years be made with 10 ft. ties and later with those of standard length.

On lighter traffic lines where settlement is slower and where long cedar ties have been used, good headway may be obtained by unloading a heavy coat of ballast and then renewing all of the ties completely with standard length ties by lifting the rails away from the long ties at least a foot. As settlement continues the long ties will eventually be buried, or often submerged in water. Their life will therefore be greatly extended, resulting in a track over soft ground on standard ties but much more secure than before, as well as track which may be handled by the ordinary section forces.

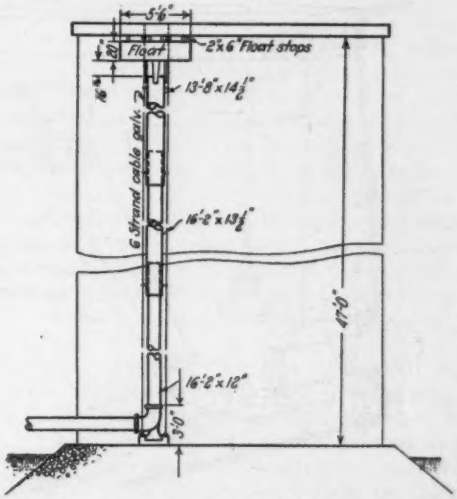
A MAINTENANCE ENGINEER.

Floating Intakes for Water Tanks

What is the best design for a floating intake in roadside or settling tanks where it is desired to draw off the water from the top?

First Answer

The ordinary swing float type is a suitable form of intake arrangement for all tanks which are wider than they are high or where the bottom portion is not to be



The Telescopic Arrangement As Used on the Rock Island

used. Where the tanks are high and narrow the telescopic type is considered the best, as this will permit utilizing a larger portion of the tank for storage purposes. A number of intake arrangements of this type are in use on the Chicago, Rock Island & Pacific.

The illustration shows the plan of construction for a 24-ft. by 47-ft. tank. The equipment consists of one length of steel pipe 12 in. in diameter and 16 ft. 2 in. long, extending upward from a base elbow attached to the bottom of the tank. This pipe is surmounted by two sections of galvanized pipe, each lapping over the other, the lower section being 13½ in. in diameter and 16 ft. 2 in. long, while the upper section is 14½ in. in diameter and 13 ft. 8 in. long. These pipes are supported by a cylindrical float directly above the top sec-

tion, while two six-strand galvanized wire cables attached to the floor and top of the tank serve as guides for the telescopic pipe during raising or lowering. This arrangement makes it possible to draw off water down to within 17 ft. of the bottom of the tank and is of advantage, moreover, in that it can be installed near one side of the tank so as to avoid complications where a down-take pipe for mixing chemicals occupies the central portion of the tank. Should the galvanized pipes fail to telescope of their own weight, the position and weight of the float is such as to insure the downward movement.

P. M. La Bach,
Engineer Water Service, Chicago, Rock Island & Pacific, Chicago.

Second Answer

There are various methods of drawing water from the top surfaces of settling tanks or from the upper levels of other sources of supply. Two sketches are submitted showing how this may be done. These sketches are drawn from experience obtained in Great Britain and Australia. Either type will give perfect satisfaction. If the swinging elbows, as shown in the sketches, are not readily obtainable, flexible pipe joints and flange elbows will do just as well. The hopper pipe and float may be made of material least affected by the water to be handled. The pipe sizes depend on capacity requirements.

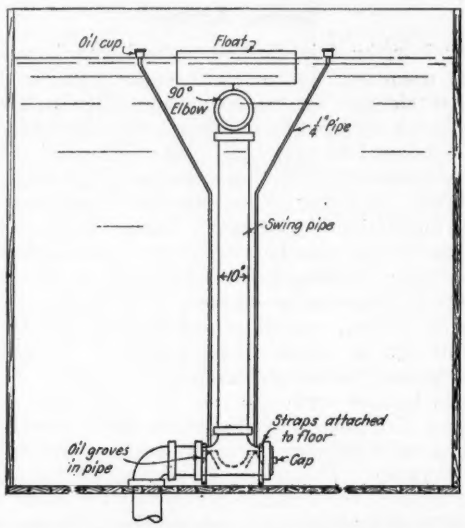
The single float type is not adjustable and is intended for small or medium capacities. The double float type is adjustable and is used where large tanks having greater capacities are required. The supporting clamps attached to the adjusting bolts fit around the intake flanges loosely enough to allow free movement and proper balance of the float.

H. P. Blake,
Engineer Water Supply and Heating Department, Canadian National, Winnipeg, Man.

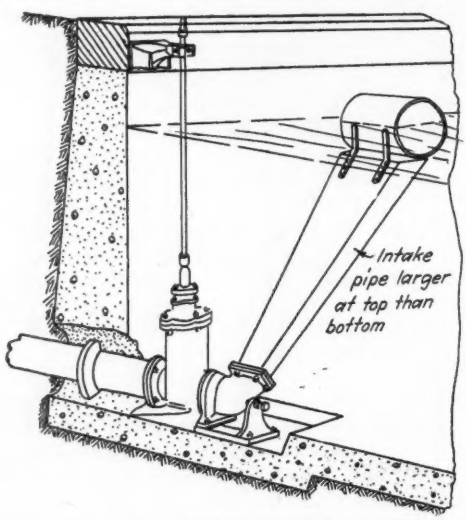
Third Answer

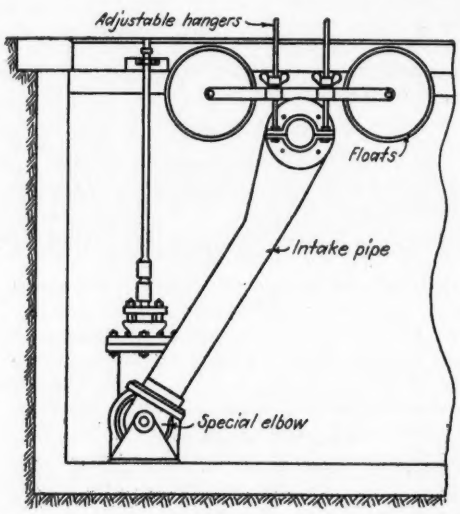
The accompanying diagram shows a floating intake which can be made easily and has proved to be very satisfactory in service. The device consists of a length of steel pipe attached to a swinging joint at the bottom of the tank. The swinging joint is the important detail of this arrangement. It consists of an extra heavy pipe tee which revolves on a length of wrought iron pipe, one end of which is screwed into the elbow of the outlet pipe. The pipe itself is turned down until perfectly round and is made just long enough so that a pipe cap screwed on the end will make a snug fit with the tee when in position. A cut is made in the pipe so that a full opening is always provided for the passage of water, regardless of the slope of the intake pipe. The tee itself is cut out inside until it will slip over this pipe. A strap is provided at each end of the connection to hold it firmly to the floor and oil grooves are cut on the surface of the pipe to afford lubrication to the joints. Both pipe and tee are well oiled when first put together but for subsequent oiling the tee is tapped on both sides of the intake pipe just above the grooves on the pipe and two lengths of quarter inch pipe are extended to a point above the water where grease cups are attached. The intake end of the swinging pipe is supported by a cylindrical float and is fitted with a 90-deg. elbow, the latter to prevent the entrance of any scum which may be on the surface of the water.

Experience has shown that practically no sludge finds its way into the water when this form of intake is properly made and also that it gives less trouble than where threaded joints are depended upon for swinging the



The Home-Made Intake Arrangement As Tried Out on the Great Northern





British Designs With Adjustable Floats and Hopper Intake Pipes

movement. Practically this same design has been used with a wooden box for a suction. This eliminates the need for a tee and the float but in time the wear allows a little sludge to enter the pipe. B. W. DEGEER,
Water Service Engineer, Great Northern, St. Paul, Minn.

Exchanging Old Tools for New

To what extent is it practicable to require foremen to turn in old tools in exchange when requesting new ones?

First Answer

A foreman should always be required to turn in the old tools when requesting new ones, as parts of the old tools at least can always be found. V. J. CASSANO,
Section Foreman, Great Northern, Summit, Mont.

Second Answer

It is considered good practice on the Great Northern to require foremen to turn in tools in exchange when requesting new ones, the roadmaster passing on all cases of loss where an exchange cannot be made.

J. J. HESS,
General Roadmaster, Great Northern, Seattle, Wash.

Third Answer

There is a limit to which it is practical to require old tools to be exchanged for new ones. If the foreman needs a new tool and the old one has no salvage value he should not be made to produce it. When discussing the subject of exchanging tools there is another point which should be mentioned. Some foremen have their favorite tools and will not exchange them unless compelled to do so. They get accustomed to a certain tool to such an extent that they do not like to turn it in and break in a new one. This is a good thing in a way but when tools become worn to such a point that they cannot be used safely, an exchange of such tools should be required. A foreman should also be required to turn in those tools which are no longer of use to him in order that they may be sent to other foremen.

G. E. STEWART,
Assistant Engineer, Southern Pacific, Stockton, Cal.

Removing Track Shims

What precautions should be observed when removing track shims as the frost leaves the ground in the spring?

First Answer

Before removing shims from track a flagman should be stationed in each direction. The shims should be removed as early as possible in the spring. After the shims are removed it is my practice to preserve the long spike in the tool house for future use. Tie plugs should be driven in the holes. The track should be gaged and the ties tamped to give a solid bearing.

R. ROSSI,
General Foreman, Markham Yard Construction, Illinois Central, South Harvey, Ill.

Second Answer

In removing shims from the track as the frost leaves the ground, precaution should be taken so that too many shims are not removed at one place, leaving the track uneven. To remove the shims too soon sometimes causes broken rails. When removing the shims, great care should be taken to plug all the old holes and to adze the ties so that the tie plates will rest squarely on them.

Giving the plates a uniform bearing surface and proper line helps in keeping the spikes from loosening and giving rise to spread track.

The track should be gaged and spike lined, as it is found that the track is always spread to some extent where shimming has been done. All ties should be well tamped as failure to do so sometimes causes rails to rest on the edge of the tie plate, causing the spikes to break or bend and also developing wide gage.

THOR MONRAD,
Foreman, Northern Pacific, Ollie, Mont.

Third Answer

Generally speaking, it is necessary to take the same precautions in removing small shims from the track as the frost leaves the ground, as should be taken when tie plates are being applied. When shims are being removed, the temperature is rising, resulting in a general taking up of expansion. It is, therefore, of first importance, before removing spikes, to determine the possibility of track buckling. Small shims may be removed by first pulling the spikes on alternate ties and loosening the others.

When shims over one inch in thickness are being removed the work should be done under restricted speed of traffic, but it is seldom that shims of such thickness can be removed without replacing them with shims of slightly smaller thickness, as it usually takes the frost some time to leave the ground, and shims must be gradually reduced until the track settles back to its original position. It is quite important that precautions be taken to keep the track level, as the frost often leaves the ground faster on one side of the track than on the other, especially on embankments. J. E. FANNING,
District Engineer, Illinois Central, Waterloo, Iowa.

Fourth Answer

One of the first duties in connection with the removal of shims from track is to drain all pools in or about the track which are sometimes left after the upheaval. Track forces should go over the track daily and examine very closely places where shims were inserted, because where heavy shims have been used these spots will invariably have to be reshimmed before the other shims can be removed, since the sun and warm weather will cause the roadbed under the shims to recede in advance of the high spots. When the high spots begin to thaw out, care must be taken to remove the shims as nearly as possible in the reverse order in which they were placed and they should not all be removed at one time but rather by successive stages, otherwise very rough track will result.

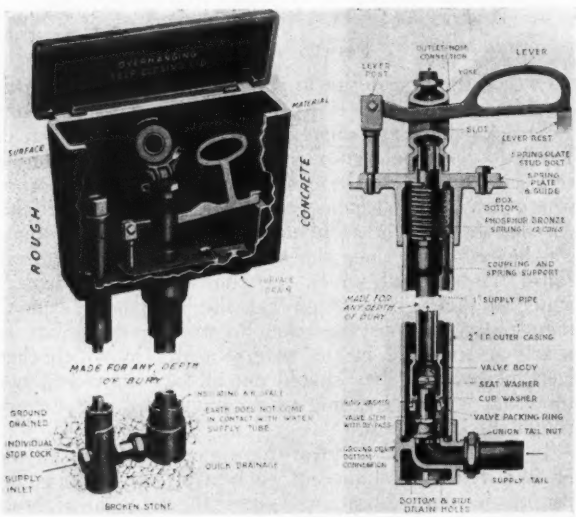
In each stage of removal the same precautions should be followed as in shimming, such as proper flagging, the use of tie plugs, shimming spikes, the removal of bracing, etc. Where the roadbed is of a poor and nonporous material and especially where the roadbed is thawed out exclusively by the sun's rays, one side of the heaved spot may give way before the other. Since it is the tendency of ties to hang to the rail, where only two or three ties are loose, and thereby give an appearance of undisturbed track, it is important for section foremen to resort to the sounding test each day, which consists in striking both ends of all ties with a hammer or adze to detect any cavities. After the frost has completely left the roadbed and especially at water plugs and crossings, it is the tendency of fine sand or sediment to wash into the open spaces in the coarser material. This necessitates the surfacing of the track as the shims are renewed at such points or preferably digging out the high spots and refilling with proper material. After the shims have been removed they should be graded and stored away under cover, along with the shimming braces for the next year's use. F. LISTON,
Canadian Pacific, Vaudreuil Station, Quebec.

Getting the Manufacturers' Help

Some Practical Hints on Labor Saving Equipment

Water Hydrant Improvement Facilitates Repairs

THE constant use of hydrants at coach yards, cinder pits and other points in railway terminals frequently makes it desirable to maintain a system of water distribution that will permit the repair of any one hydrant without interruption to others. This requirement has resulted in the development of an improved form of water service box, which was originally designed exclusively for use at



The New Water Box. The Hydrant Installed

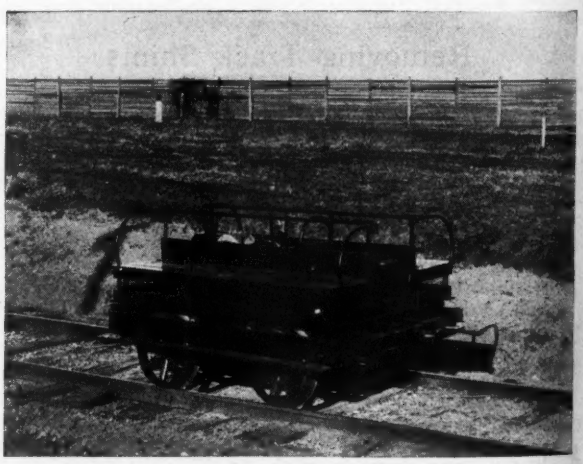
ash pits and similar railroad facilities, where it is desired to avoid any extensions above the ground, over which workmen could trip and where it is desired at the same time to maintain either a wide open or tightly shut condition of the valve. The Murdock Manufacturing and Supply Company, Cincinnati, Ohio, met this situation with a hydrant consisting of a cast iron valve box with a cover, which is sunk into the ground flush with the surface, and contains a hose connection so designed that a wide open condition of the valve is obtained immediately upon pulling a lever upward. Below the box the hydrant includes an arrangement which drains the water away, either directly into the ground at the bottom or through into a sewer connection, in such a way as to prevent freezing.

The improved feature in this water service box is an individual stop cock which enables each box to be shut off separately from the others if desired.

Another point of interest in this box since its development two years ago is the fact that there are now 11 types, thus enlarging its use for other than coach yards and around terminals. The outstanding features of the equipment in the improved form are: (1) that it is either fully turned on or completely shut off, (2) the ease with which the inner parts can be removed and washers renewed without having to dig up or disturb the main fixture, (3) the simplicity and ruggedness of equipment, (4) the fact that it is flush with the ground, with nothing to receive injury or to stumble over, and (5) its resistance against freezing.

Making the Motor Car Fit the Size of the Gang

RESPONDING to a demand for a section motor car which will carry a large gang in busy seasons and which can also be quickly stripped to reduce its weight so that it can be handled easily by a minimum gang in the winter, Fairmont Railway Motors, Inc., Fairmont, Minn., has introduced its Fairmont Class S11 car. One of the



The New Car Complete for Heavy Service

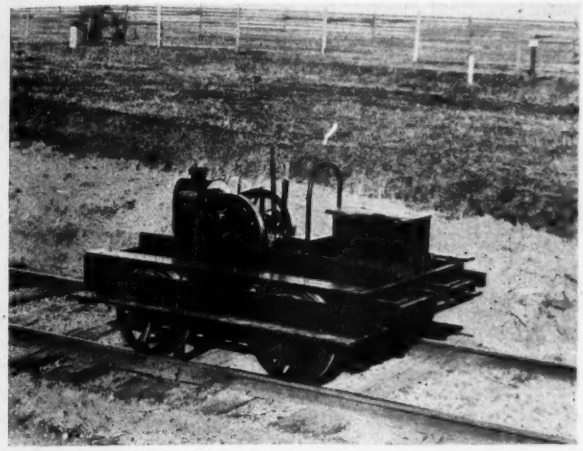
photographs shows this car equipped for heavy duty while the other shows it stripped for small gang service. As is readily seen, the entire upper part of the car is arranged so that by the removal of a few bolts, it can be lifted off and set aside during the slack season. The change is easily made in 20 min. or less.

The car consists essentially of the standard frame, equipped with axles, Hyatt bearings and the 6 hp. ball-

bearing engine used in the Fairmont Class Ma Santa Fe type car. The removable side seats and tool boxes with railing are rigidly built into a single unit.

A feature of the car is the side foot rails. These ordinarily serve as convenient foot boards when the gang rides on the car. However, they are reinforced by angle iron supports so as to have sufficient strength to carry a standard 33-ft. rail.

The controls of the car are arranged for easy access by the operator who sits on a central seat between the

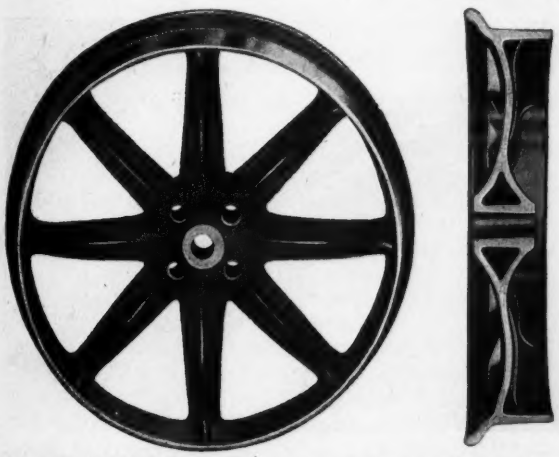


The Car as Stripped for Use by a Small Gang

two side seats. This arrangement affords the operator clear vision both ways. The car has a seating capacity of 11 men and is provided with two large tool compartments with hinged covers which will carry all of the tools needed by such a gang. The engine is located where it is easy to get at for cleaning and adjustment.

A New Motor Car Wheel

THE exacting requirements of motor car operation have led to the concentration of effort on the perfection of one item, the wheels, with the resulting development of the Parsons wheel, recently put on the market by



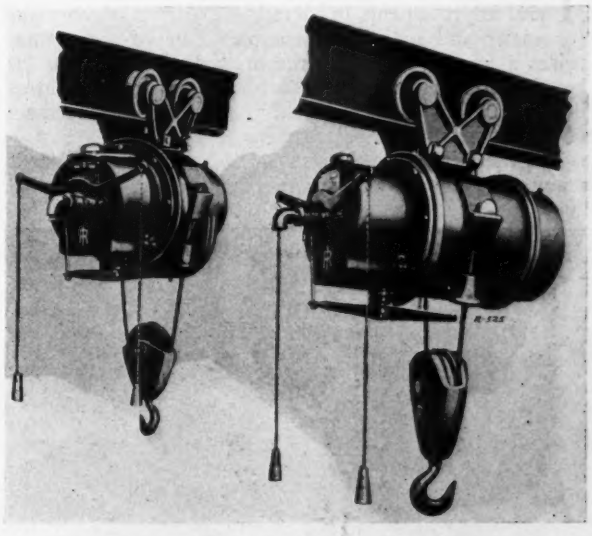
All Parts of the Wheel Are of Uniform Thickness

the Electric Tie Tamper & Equipment Company, Chicago. This wheel is entirely in one piece from hub to tread. It is cast from electric furnace carbon steel by a pressure process, insuring a light-weight, homogeneous product. As seen in the cross sectional view all parts are of a uniform thickness except that additional material has been put in the tread and flange to insure long wear. The tread is ground to an accurate finish concentric with the center line of the hub so that the wheel will run true. These wheels are furnished in diameters ranging from 16 in. to 20 in. but may be had in special sizes if required. They are made either insulated or non-insulated to fit any standard axle.

New Air Hoists Are Applied for Many Practical Purposes

THE Ingersoll-Rand Company, New York, has developed a new line of air motor hoists in five different sizes with capacities ranging from 500 to 10,000 lb. These hoists are suited for a wide range of service where rapid and economical lifting and handling of loads is desired. The essential details of the five sizes are given in the table.

The outstanding characteristics of the new hoists are briefly as follows: They are compact and thus require little head room; they are of relatively light weight; they embody an automatic brake which holds the load in case



Two of the New Air Motor Hoists

the air supply is disconnected or fails, and a graduated throttle permits a close regulation of both the lifting and the lowering speeds. A safety stop lever is provided which closes the throttle and stops the motor whenever the load is, by chance, raised to the top of the hoist lift.

A balanced three-cylinder air motor is used which operates in either direction at any speed or load within the rated capacity of the machine. Some of the advantages claimed for this motor are its freedom from vibration, the ready manner in which it can be throttled down slowly at all loads and the absence of lubricating troubles, even when subjected to considerable neglect. Both the motor and gears are enclosed. The motor operates in a bath of oil and the gears turn in a heavy grease. Oil passages lead to all the bearings.

The automatic brake which holds the load at any desired position for any length of time, regardless of air pressure, consists of a disc attached to the motor shaft and of a brake plunger with a friction face which is held in contact with the disc by springs whenever the

hoist is not operating, i. e., whenever the air supply to the motor is cut off, either by throttling or otherwise. It is entirely automatic in its action and requires no attention from the operator.

Principal Characteristics of the Air Motor Hoists

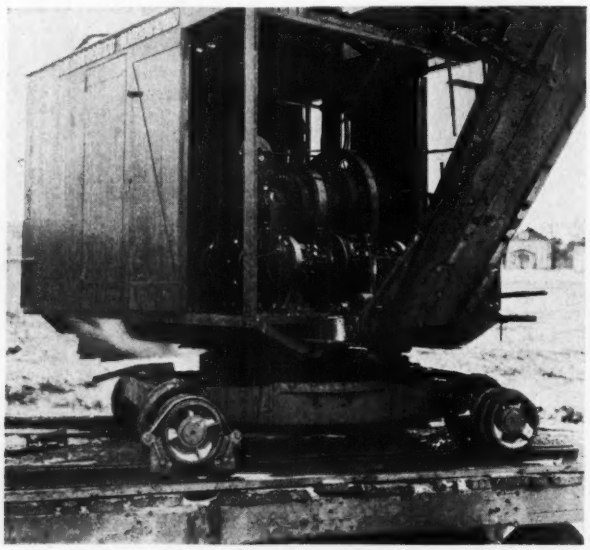
Size	A	B	C	D	E
Capacity (lb.).....	500	1,000	2,000	4,000	10,000
Feet lift per min. (80 lb. air pres.).....	50	25	25	17	10
Max. lift feet.....	15	15	15	15	15
Size of wire rope, in.	¼	¼	5/16	⅜	9/16
Length of wire rope, feet	35	35	36	36	40
Net weight (equipped with top hook) lb.	150	150	315	425	760

The hoists are being used continually in outdoor work where they are necessarily exposed to all kinds of weather and are called upon to respond to the control of any one who may be at liberty to use them. It is said that hot, dusty, steaming, smoky or acid-laden air does not affect them adversely. These hoists operate on air pressure from 60 to 100 lb.

Making It Easier for the Ditcher Operator

THE Osgood Company, Marion, Ohio, has made several improvements in its railroad ditcher which make for easier and speedier operation. One of these comprises a friction clutch of the multiple-disk type on the hoisting engine shaft which enables the operator to throw in the travel mechanism quickly for the rapid movement of the ditcher.

In general practice the flat car on which the ditcher is mounted is coupled between two dump cars. The ditcher



A Close-up View of the Control Mechanism

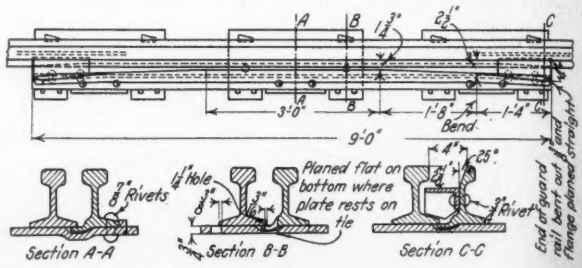
then moves from one end of the flat car to the other in order to load both dump cars. In case the dump cars are of unusual length, it is necessary to dump the dipper at the greatest extension of the dipper handle and then push the dirt ahead in the car with the dipper. All this manipulation calls for speed and ease in movement of the ditcher, and with this friction clutch considerable added mobility is attained.

Another important feature in combination with the friction clutch is a foot-operated brake band which holds the ditcher stationary on the flat car when digging or thrusting the dipper without the use of any other locking device. The usual tendency of a ditcher in digging is to run back when crowding the dipper. But with the brake band on the clutch drum it is possible for the operator to lock and hold the ditcher effectually at any point on the flat car. The ditcher is immediately released for movement by relieving the pressure on the foot pedal.

The operation of the hoisting engine has been much simplified by an arrangement whereby the steam friction clutch on the hoisting drum is set and released by the same lever that controls the hoisting engine throttle. This arrangement does away with one lever, leaving but three throttle levers to control the hoisting, crowding and swinging engines. The lowering friction on the hoisting drum is foot-operated. However, the hoisting friction control can be connected quickly for operation by a separate lever, if the operator so desires. In short, the ditcher is equipped for three of four lever control at will.

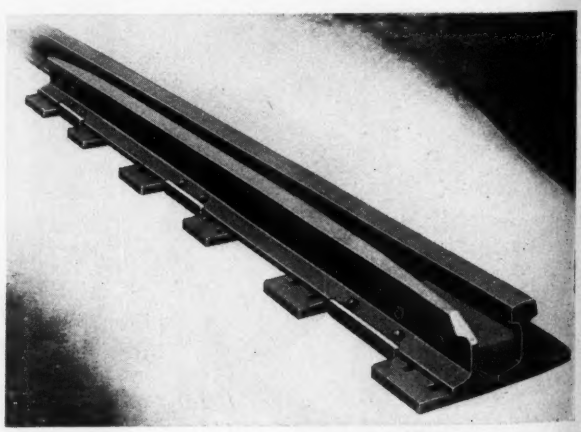
One-Piece Guard Rail Made of Rolled Steel

DURING the last few years there has been a rapid development in what is known as the one-piece guard rail, made either of cast carbon steel or cast manganese steel, but some roads have hesitated to use this form of



Details of the New Guard Rail

guard rail in high-speed main line tracks. For this reason the Bethlehem Steel Company, Bethlehem, Pa., which has had an important part in the development of the one-piece guard rail, has spent considerable time and effort in perfecting a guard rail which possesses the general charac-



A View of the Complete Guard Rail as Assembled with the Stock Rail

teristics of the one-piece type but is made of rolled steel according to a design which makes it available for use in high speed main line tracks as well as in yards or sidings.

This guard rail derives its resistance to overturning from the thrust of the wheel flanges by a rolled depression of the flange on one side which hooks under the main rail for its entire length. It is also provided with three heavy two-tie base plates. The guard rail is complete with foot guards riveted at either end and is delivered ready to install without the addition of any loose parts such as clamps, braces, tie plates, filler blocks, bolts, etc. The guard rail is made of high-carbon, long-wearing steel, whereas, the base plates are made of tough, ductile steel suitable for the purpose. As will be noted in the drawing the required flare at each end is obtained by a slight bending of the rail, supplemented by planing the inner face of the rail head, commencing at a point three feet from each end. To allow for adjustments to take up wear a staggered spike notching has been provided in the base plates along the outer side of the stock rail.

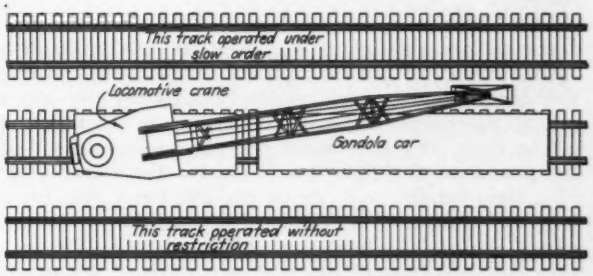
A Special Crane for Ballast Cleaning Service

AN illustration of what may be done in the design of special equipment for a particular purpose is to be had in a locomotive crane recently built by the Industrial Works, Bay City, Mich., for use in ballast cleaning service. The Pennsylvania, in common with other roads, has been using locomotive cranes in connection with special

The Rear of the Crane Is Narrow

screens mounted on gondola or ballast cars for cleaning ballast on heavy traffic lines, where the rapid fouling of ballast requires this operation to be repeated at frequent intervals. Briefly, this operation consists in removing the ballast from between the ties by hand and heaping it in piles between the tracks, after which a locomotive crane, equipped with a clam shell bucket, picks up the ballast and drops it on the screen mounted over the car, the foreign matter depositing in the car and the ballast rolling back into the inter-track space. One difficulty encountered in the use of this method arises from the fact that the rear corners of the crane, even when turned at the slight angle necessary for the bucket to operate in the space between tracks, projects into the operating clearance of the adjoining track and introduces considerable interference with the movement of trains on that track, entirely aside from the crane's occupancy of one of the tracks.

To overcome this trouble, the Industrial Works has built a new crane in which the rear end of the crane body is tapered off on each side so that the crane can be swung as far as is necessary for this work without interference with the adjoining track. This change in the design has made it necessary to use a 56-in. boiler and since it allows no space for a fireman, oil burning equipment is used. The necessary water storage is provided in a number of small tanks having a total capacity of 500 gal. Another feature of the design is a positive stop which prevents



How the Crane Is Used in Ballast Cleaning

the crane from swinging far enough to cause an obstruction, this stop being equipped with a shock-absorbing device so that the swinging of the crane is retarded without any injurious effect on the crane structure. This crane will be operated by John F. Casey & Co., of Pittsburgh, in ballast cleaning operations on the Pennsylvania.

A New Design of Track Jack

A TRACK jack which uses the common wrench for a lever and which is light enough to be picked up and carried easily by a trackman along with his pick and shovel is the most recent addition to the tools which have been developed for the use of track forces. The new device is called the Idol track jack and tie spacer. As the name implies, it is a companion tool to

Using the Jack for Tie Spacing

the Idol track liner, and has much the same appearance as the latter tool.

The jack is only 10 in. high and weighs, complete, less than 25 lb. The parts are five in number, the jack stand, the rack and toe, a lifting cog, a combined holding and tripping casting and the pinion which holds the latter in place. The lifting cog and the pinion are in one piece with one end of the pinion made square

to fit the ordinary track wrench, providing for this means of operating the jack rather than the use of a special handle or a lining bar.

That the use of a wrench for a jack handle gives sufficient lifting power is indicated by tests made within the last month in the laboratory of Armour Institute of Technology, Chicago, where the lifting force of the jack was found to be 4,700 lb., when using the 2½ ft. wrench. And 7,250 lb. when using a 2½ ft. pipe extension on the wrench.

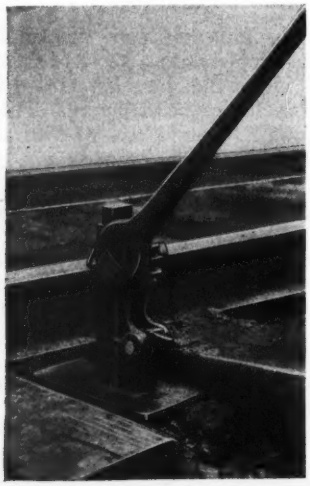
The lifting cog is carried near the top of the jack frame on one side where it is held securely in position against dropping out accidentally, while easily removable by raising the rack slightly and giving the cog a rolling movement outward. The position of this cog can be reversed at will in order to put the jacking end of the pinion on the right hand side for the convenience of a right-handed man, or on the left hand side for a left-handed man. When the cog is out, the rack is removed simply by raising the jack stand, when the rack falls out. This ready removal of parts is of advantage if repairs should be desired since it eliminates the necessity of sending the entire jack into headquarters. For carrying the jack, a handle is provided in the jack stand which may be grasped by the hand or through which a track wrench may be thrust and the jack carried on the shoulder.

The lift of the jack is six inches which is said to adapt it for the ordinary surfacing encountered in routine maintenance and especially for raising low joints, the latter being one of the two primary purposes for which the jack was designed. The jack is said to perform the work with unusual rapidity, since one-half a turn of the lifting cog (which may sometimes be done without removing the wrench) lifts the rack three inches. That the jack will hold the full load at this height was indicated by a test conducted in the testing laboratory of the Armour Institute, Chicago. In this case the jack was raised to the full height and pressure was applied to the head until the load reached 26,000 lbs. This load broke the bottom tooth in the rack and kinked the biting end of the dog. The rack, however, did not drop under the load. In practice the jack is lowered the whole distance simply by removing the wrench and striking the trip, or it may be lowered a notch at a time by holding the wrench in position during the operation.

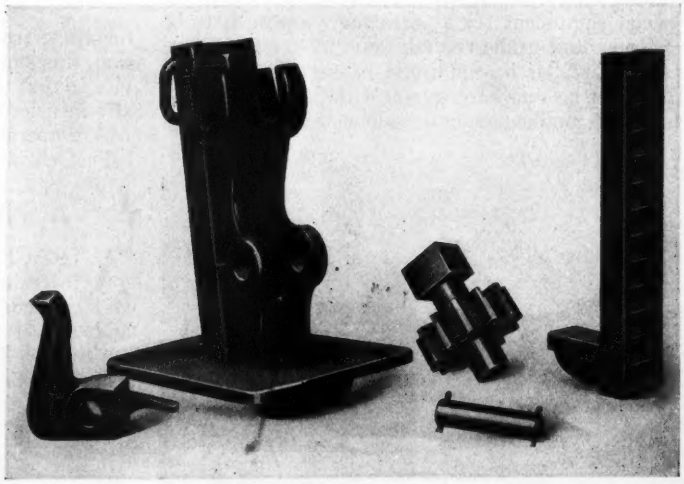
A second operation for which the jack was specially designed is that of tie spacing. The usual methods of spacing ties by striking them with a track maul or prying them into position with a lining bar, are often ineffective and damage the timber. With the new jack the spacing is done by laying the jack on its side, putting the base against the bracing tie and the top of the jack against the other. For this purpose, an auxiliary plate is furnished which fits on the toe of the jack, giving a larger bearing surface. This plate may also be used when raising the track to distribute the lifting load over a larger area of the base of the rail.

The small size of the jack, aside from its advantage when it is desired to work in tight places, is also mentioned as a safety factor since the jack may be left in the track without danger of being struck from passing trains. Among other uses, the jack is also mentioned as being useful at wrecks since it will operate in one direction as well as another. When attempting to regage sprung track at a derailment the jack can be placed between the two tracks with a chain from one rail around the base and a chain from the other rail around the toe of the jack, and the jack then forced in the backward direction, drawing the two rails together.

The jack is being manufactured by the Idol Track Liner Company, Chicago.



The Track Wrench is the Handle



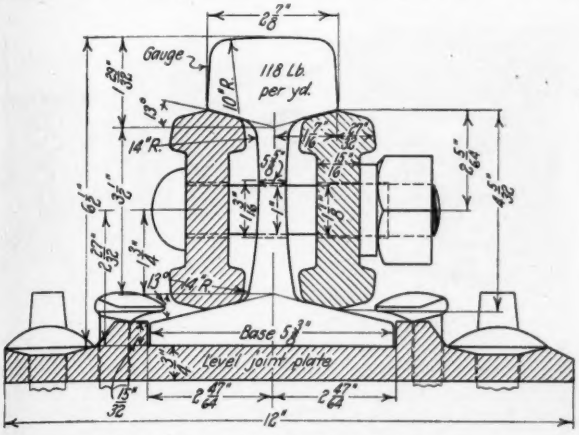
The New Jack Can Readily Be Taken Down

New Joint Reduces Cost of Maintenance

ONE OF THE problems of the track forces which requires a large amount of labor is the maintenance of track joint and joint ties, the latter having a tendency to slew, even under the best conditions of maintenance. In an effort to solve this problem of joint maintenance, a new type of joint has been developed and tried out on the Delaware, Lackawanna & Western by A. J. Neafie, principal assistant engineer. This joint consists of two independent parts, a base plate and a pair of splice bars. As it will be seen from the illustration where the joint is shown in conjunction with the new 118-lb. rail recently adopted by the Lackawanna, the rail ends are joined together with two 27-in. six-hole splice bars and are carried on a ¾ in. base plate 12¾-in. wide by 27-in. long. These splice bars have a minimum thickness of 15-16 in. and are uniform in cross section, thus permitting them to be turned end for end or to be turned over to provide a new wearing

surface. Track bolts one inch in diameter are used with Verona rail joint springs. The base plate is shouldered on both sides of the rail to a height of 15-32 in. and for the full length of the plate.

The rail itself is held to the plate by cut spikes driven down on the shoulder and leaving a small amount of play between the base of the rail and the spike. The plate itself is supported over two ties to which it is



Cross-Section of the New Rail Joint

screw-spiked solidly. Thus, the rail ends are held firmly together and solidly supported, yet are free to move one way or the other without transmitting any thrust upon the base plate or the joint ties. In order to secure easy access to the cut pikes, of which only two are used, one on each end and on opposite sides, the bolts are arranged with the nuts on the two outside bolts on one side of the rail and those of the intermediate bolts on the other.

In applying these joints the ends of the rail are supported at the center of the plate, i. e., between the ties.

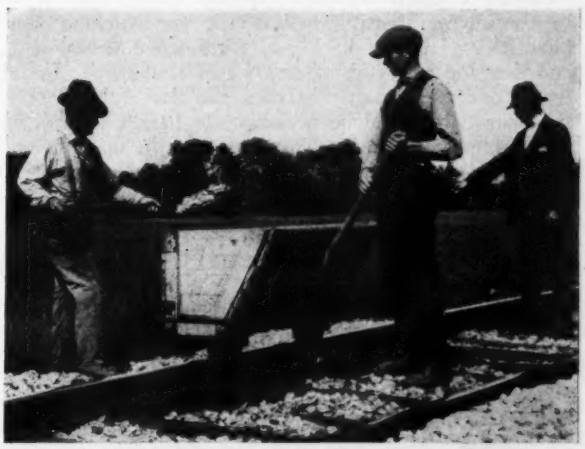
The Joints are Equipped with Rail Joint Springs

When the rail has moved, due to creeping, until the ends have come over the center of one of the ties, the spiks are removed and the base plate slid ahead one tie where it again is spiked in position. The tie plate on this adjoining tie is of the same general cross-section as the base plate, with the same location of spike holes so that it is not necessary to drill new spike holes. When the base plate is moved ahead one tie, this tie plate is moved back to the tie which has been uncovered.

The results which have been obtained with this joint arrangement have been quite satisfactory to the railroad, the track supervisors and foremen reporting that it has practically eliminated the labor expense of low joints and skewed joint ties. From a structural standpoint it is interesting that although this type of joint has been tried experimentally for three years, no splice bars have broken under service. This joint is now being manufactured by the Rail Joint Company, New York.

The Trackbarrow Facilitates Section Work

SECTION and bridge and building forces are often handicapped by the lack of sufficient men to perform certain classes of work which require considerable concentrated effort. This is particularly true in the winter when section gangs are often reduced to one or two



The Ballast Box Permits Two Men to Dress Up Newly Ballasted Track

men and a foreman. Taking a broken rail as an illustration, it is generally necessary under such conditions to secure additional help from adjoining gangs to load a new rail on a motor car or a push car, with a resulting large labor cost for the work. An interesting device to facilitate this work is manufactured by the American Trackbarrow Company, Lowell, Mass. This labor saving device, although made in a variety of forms, con-

One Man Handles Heavy Track Materials, Yet Can Quickly Clear the Track for Trains

sists essentially of a frame or body mounted upon two small flanged wheels and so arranged that it is practically balanced when it is placed upon one of the running rails of a railway track. Being low in height it is possible for a few men to bar heavy objects up on its platform, after which it can be pushed along the track easily by one man.

One road which has utilized a number of these devices uses them for transporting heavy timbers such as 8-in. by 16-in. stringers and 12-in. by 12-in. caps, over short distances, thus dispensing with large gangs or crane service where such service would ordinarily be uneconomical. In the track department it uses them for handling heavy track materials such as guard rails, etc., for transporting a rail to replace a broken one, thus permitting three or four men to do the work formerly requiring a larger number. It also utilizes this device in conjunction with a ballast box for trucking small quantities of ballast back and forth when trimming up and dressing a stretch of newly ballasted track. In this work, one man readily handles the device in place of the four that would be necessary to handle a push car with dump boxes on it. The device can be upset in such a manner that the track can be cleared instantly for the passage of trains.

A Tool to Make Concrete Breaking Easy

THERE IS NOW on the market a tool specially designed to make easier and quicker the accomplishment of work involving the breaking up of concrete retaining walls or concrete foundations, etc., such as is now extensively encountered in railway construction and maintenance work. This is an air-operated tool known as the concrete breaker hammer drill, developed by the Sullivan Machinery Company, Chicago. This tool weighs 65 lbs., takes a special chisel or pick point drill 1⅛ in. in diameter and ¾ in. air hose. The design throughout is such as to enable one man to carry on without difficulty and with unusual dispatch almost any character of work involving the breaking up of concrete or similar material. Its operating requirements are within the scope of a small portable air compressor driven by a gasoline engine or an electric motor. The drilling outfit is self-contained and independent and can be moved from place to place as rapidly as the work at one point is completed. This makes unnecessary long runs for piping or hose.

The Sullivan Concrete Breaker

The tool consists of a cylinder containing a floating hammer piston which transmits the blows to the shank of the drilling tool. The movement of the piston is controlled by a cylindrical hollow shell valve, housed in the valve box, together with its cap, all of which are situated in the cylinder head. The rear of the cylinder head block terminates in heavy arms which provide a double grip handle for the operator. Air is admitted through an inlet opening at one side of the head block and is controlled by a push-lever trigger or throttle valve so located in one of the handles that the drill is stopped immediately upon releasing the pressure on the handles.

The drill shank is 6⅛ in. long. The drill retainer is provided with trunnions so that it may be swung back out of the way when changing drills and is also provided with heavy coil springs on each arm to take up the shock and vibration of drilling. Lubrication is accomplished by means of an automatic impulse oiler which admits a small amount of air to the valve at each stroke. The reservoir for the oil is in the handle. Every part of the tool is accessible by loosening three nuts. There are no screw joints present.

The portable character of the drill enables it to be used advantageously in confined places and makes it of special advantage in breaking out asphalt or concrete between railroad ties, along rails, and between girders where men and hand sledges could not operate conveniently. In removing pavement incident to the railroad tracks changes in Ogden, Utah, recently, the outfit is reported to have not only paid for itself on the one job, but to have saved a great deal of time. In another case on railway terminal work the tool is reported to have dug out 20 cu. ft. of heavy retaining wall per day.

Concrete Breakers in Use at Ogden, Utah

The Electric Tamper Becomes Factor in Extra Gang Work

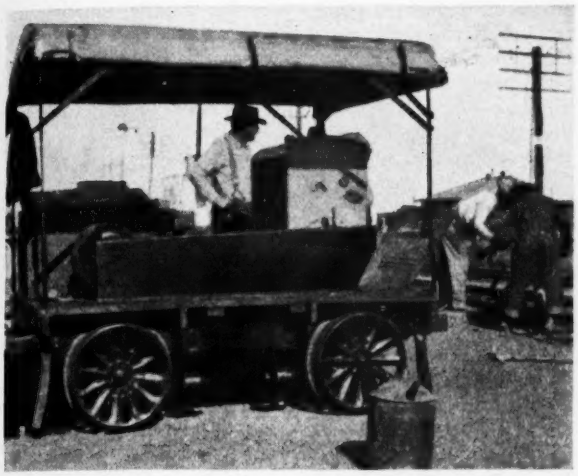
AN average cost of $180 per mile for general surfacing operations on 14 miles of rock ballasted track is a record obtained on a southwestern road last season with electric tie tampers. It serves not only as an illustration of the economies to be obtained through the application of mechanical equipment to track work but, also, marks the tendency toward the use of the equipment on a more intensive basis by providing enough power tools for an entire extra gang so that all of the tie tamping may be done mechanically.

How Eight of the Tampers Are Used on One Tie

The standard outfit furnished by the Electric Tie Tamper and Equipment Company, Chicago, embraces a

gas-engine-generator set capable of supplying current to four electric tampers and in a number of cases, a sufficient number of four-tool outfits were furnished to the extra gangs to do all the tamping required.

In place of operating four tampers, as is customary in ordinary section work, the most satisfactory results were obtained by working the tampers in batteries of eight, four machines operating on each tie outside the rail and four other machines working on the same tie



Special Gas Engine Generator Set Designed to Drive 16 Tampers

inside the rail, as illustrated in one of the photographs. Another of the illustrations shows how the two power units are placed on the shoulder of the roadbed in a convenient location with respect to the position of the gang.

It is said that the day's output which may be expected from one eight-tamper crew varies from 1,000 to 2,500 ft., depending on the lift and the kind of ballast. If experience indicates that each eight-tamper gang will complete 1,000 lin. ft. per day, the gangs are spaced 1,000 ft. apart when the work is started in the morning.

Two Generators Driven by New-Way Engines

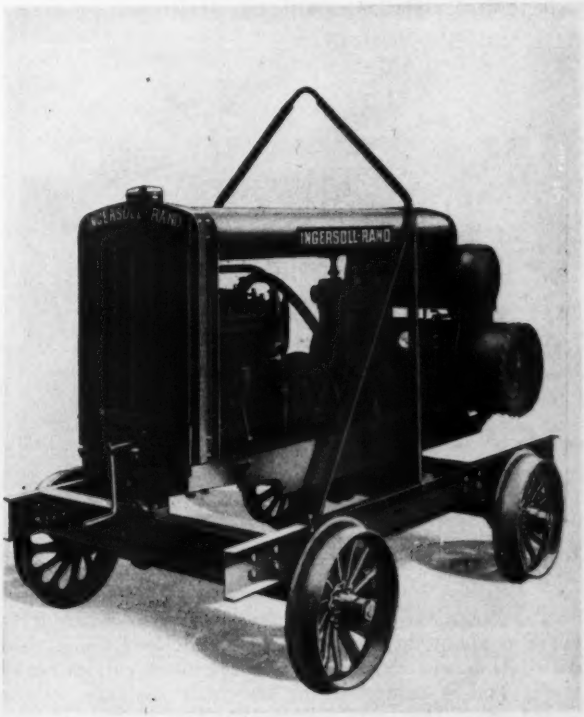
Therefore, at the end of the day, five eight-tamper gangs will complete work on almost a mile of track.

One advantage in the handling of mechanical tamping by extra gangs with the use of the four-tamper power unit lies in the fact that these four-tool outfits can be assigned to section gangs whenever it is found advisable to discontinue the extra gang operations. No difficulty is experienced in transferring the power units over the line since they are of such size and weight that they are easily handled by two or three men and can be readily transported over the line in a one-man, side drive inspection car.

Where the tamping outfits are to remain with a large gang permanently, it has been found of advantage to provide a power plant consisting of a 20-hp., four-cylinder, automobile-type engine arranged to drive an 8-kw. generator, mounted on a special car as illustrated in one of the photographs. A power plant of this kind was fitted up on the Santa Fe to provide current for 16 tampers and was used for this purpose during the past season, and, also, to provide current for driving screw spikes. General experience with the tie tamper during the past season has shown that the cost of surfacing done in connection with ballasting ranges from $180 to $300 per mile and has affected a material saving over the cost of performing the same work by hand.

A New Type of Tie Tamper Compressor

THE Ingersoll-Rand Company, New York, has recently developed a new line of tie tamper air compressors which utilize four-cylinder, four-cycle, heavy tractor type gasoline engines for power. These new



The New Compressor

compressor units, known as Type 20, are made in three sizes for operating either 4, 8 or 12 pneumatic tie tampers, or their equivalent in other compressed air tools for such maintenance work as riveting, drilling bond wire holes, operating pneumatic wrenches, etc. All of the three

sizes are essentially similar in design and construction and are developments of the 12-tool tie tamper, which was described in the last Labor Saving Number of *Railway Engineering and Maintenance*. (March, 1923.) These outfits are mounted on flanged wheels for standard gage tracks and are fitted with cross trucks and with a lifting bale for negotiating with a locomotive crane.

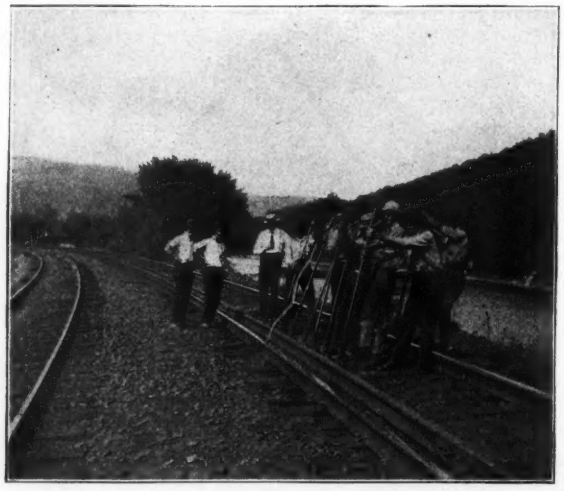
The four-cylinder motor for the 4-tool tamper has a bore of 3¾ in. and a stroke of 5½ in., driving a 5-in. by 5-in. two-cylinder air compressor. The other and larger units have a 5-in. bore by 6¼-in-stroke, gasoline motor, driving 7-in. by 6-in. and 9-in. by 8-in. two-cylinder compressors for the 8 and 12-tool units, respectively. Each of these sizes can be furnished with self-propelling mechanisms to operate at speeds of 12 miles for the 4-tool unit, 10 miles for the 8-tool and 6 miles for the 12-tool.

The motor and air compressors are direct-connected and are mounted on a single piece, cast-steel frame. With the exception of the receiver tank and the fuel tank, the entire unit is completely enclosed by a steel roof with removable steel side doors.

Track Liner Reduces Force Required to Throw Track

SINCE the publication of a description of the Idol track liner made by the Idol Track Liner Co., Chicago, in the October, 1922, issue of *Railway Maintenance Engineer*, this appliance has become a familiar item of equipment on a large number of roads and numerous records have been made which demonstrate its value in saving labor.

One of the most difficult problems which is reported to have been undertaken with this device was the lining



Lining a Three-Quarter Mile Curve on the Erie 3½ In. With Seven Men

of a six degree curve on the Erie at Deposit, N. Y. This curve is about three-quarters of a mile long and is laid with 100 lb. rail in rock ballast. The track carries heavy traffic and is protected for its entire distance with a guard rail. The work was undertaken in the summer when the rails were tight, the problem being to line the curve 3½ in. at several points. Seven men with track liners lined the track successfully without loosening the ballast except at the forward end of each tie, commencing at one p. m. and completing by nightfall. It is estimated that, with lining bars alone, this work would have required 25 men at least two days, during which time it would have been necessary to maintain slow orders for all trains.

In undertaking this work, each end of the curve was first lined outward about one-half inch for 10 to 12 rail lengths in order to reduce the strain on the joints. After this was done, six of the jacks were applied in front against the guard rail and one against the outside rail. Instead of placing the jacks at the joints first, then at the center of the rail and subsequently at the quarter points, as is usually done in lining work, the jacks were advanced a quarter point or less at a time, shifting the track half the distance in the first move and then going back over the entire track to complete the lining. In performing the work in this manner, the track was at all times in such shape that no slow orders were required.

Another difficult problem was encountered on the Louisville & Nashville at New Orleans, where four tracks are carried on the same ties, which are 28 ft. long, there being three crossovers at this point. The tracks were laid with 90 lb. rails on cinder ballast on an unusually soggy bottom, owing to the fact that the tracks are located just behind a levee along the Mississippi river. These tracks were also to be lined over 3½ in., an undertaking which it was estimated would have required 15 men with lining bars 2½ days, and continued slow orders. Seven men, each equipped with a track liner, finished the work in three hours without digging out ballast or re-surfacing the track following the completion of the lining work, and with no slow orders during the undertaking. Two jacks were placed against the forward rail, one against the next rail to the rear, two against the rail behind that and one against the other two rails involved in the work. The jacks were advanced progressively down the track.

At Homewood, Ill., on the Illinos Central, it was necessary to line the turnout from ½ to 3½ in., a problem which would have occupied a day' time with 15 to 20 men under the ordinary method. Seven men, each equipped with a liner, completed the work satisfactorily in 45 min., all shoveling of ballast between the ties being avoided as well as re-surfacing after the lining was completed. This work was done with nine re-settings of the liners.

DeVilbiss Adds to Its Line of Spray Guns

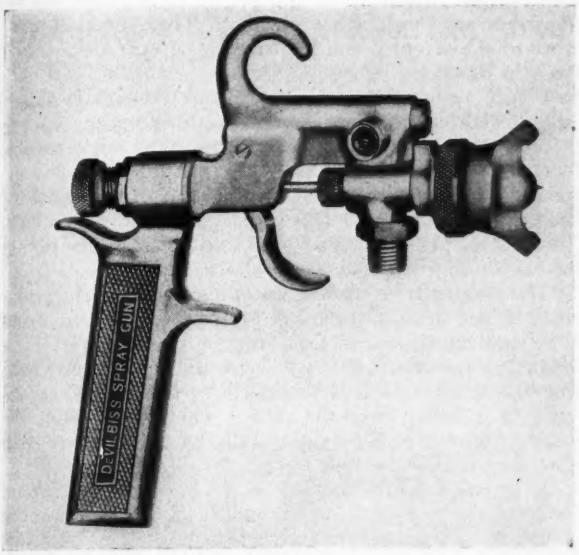
THE application of paint by mechanical means has been developed to its present state of established effectiveness as the result of a tedious process of experimentation. The equipment now in use has stood thorough tests in service but, as in any field in which the progress is rapid, improvements are being made from time to time which accrue to the benefit of the user. As an illustration of this, the DeVilbiss Manufacturing Company, Toledo, Ohio, is now introducing a new spray gun which embodies a number of distinct improvements over earlier models.

The spray head has been designed for quick removal from the body, thus making for quick and easy cleaning. This is promoted also by the fact that the fluid passes through the shortest possible passage and only three parts, the spray head, the fluid tip and the needle, come in contact with the fluid. It is said that the head can be disassembled in less than 15 sec., cleaned in 1 min., and reassembled in 20 sec.

Notwithstanding the facility for rapid disconnecting of the parts of the nozzle they are claimed to be positively self-centering, and, thus, insure a uniform spray under all conditions of service with the lowest possible combination of air and fluid pressure without causing either a

"splitting" of the spray or the introduction of a "heavy center."

The design has also resulted in reducing the weight of these guns, which, when assembled ready for use, weigh only 10¼ ounces. It is said that this weight has been so distributed with respect to the handle that the gun rests

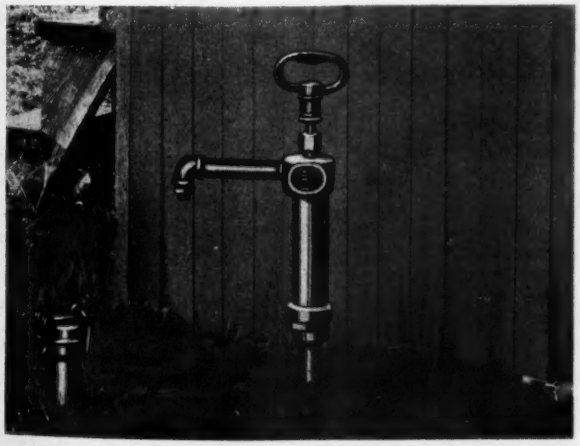


The New DeVilbiss Spray Gun

easily in the hand, thus making for non-tiring operation. This reduction in weight has been accomplished, in part, by the use of a special high-strength, heat-treated alloy aluminum drop forging. The fluid tip is made of nickel alloy steel, hardened, heat-treated and ground. This device is known as the DeVilbiss spray gun, type A.

Railroads Are Providing Better Storage For Gasoline

JUST AS the widespread use of automobiles and motor trucks has given rise to the establishment of thousands of gasoline and oil service stations, so has the general introduction of railway motor cars required the installation of safe, efficient and economical gasoline service along the railroad right-of-way. As a consequence, underground storage outfits with suitable pumps



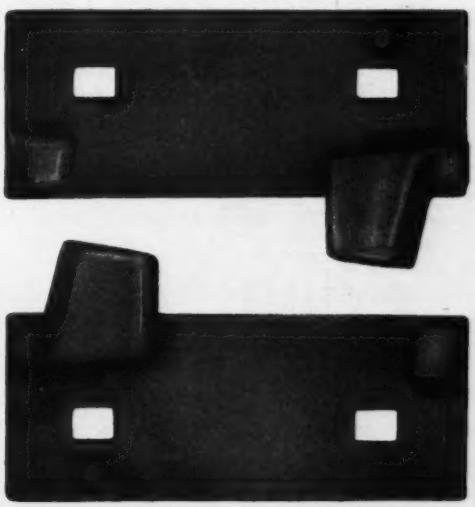
A Typical Installation of the Bowser 94A Gasoline Storage Outfit

for supplying gasoline or kerosene to motor cars and other equipment are becoming almost as common on the railroads as the familiar gas service stations along the highways. As a case in point, one type of equipment provided for this purpose, the 94A outfit, manufactured by the S. F. Bowser & Co., Ft. Wayne, Ind., was purchased to the number of several thousand by the railroads in 1923, one railroad alone ordering three carloads.

Obviously the foremost considerations which have given rise to the demand for such equipment are the greater safety against fires or disastrous explosions and the definite saving in labor to be effected by their use. The underground service installation, conveniently located, will save many hours in a year's time to the user of a motor car. However, attention is directed to another important advantage, namely, greater economy in the consumption of the gasoline or kerosene, in reduced wastage in handling and in decreased. evaporation Gasoline stored below ground where the temperature is subjected to very little change will not evaporate as rapidly as in storage above ground where it is subject to the constant fluctuations of temperature and to much higher temperatures than when a covering of the ground affords an effective insulation.

Grip Plates Serve as Rail Anchors and Rail Braces

A TRACK appliance that fulfills the combined functions of a tie plate, two-way anchor and rail brace is entitled to classification as a labor saving device. It consists of two cast steel plates, which interlock to form a single bearing for the rail on the tie. The plates are all of the same pattern with a jaw to engage the rail base on one end and a lug on the other, both being placed close to one edge of the plate so that when two of the plates are placed



Two Grip Plates in Proper Position to Be Interlocked

edge to edge the jaw of one interlocks with the lug on the other and vice versa. This arrangement has the effect of making the plates self tightening for movement of the rail in either direction, thus causing them to function as two-way rail anchors.

Obviously the grip plate serves also as a tie plate, the bearing area provided affording ample distribution of the load on the tie. The grip or jaw formed on the upper face of the plate serves as a rib, affording stiffness to resist

the bending of the plate under load. A further function of the plate is derived from the positive grip of the base by the jaws on each side. These cause the plates to act as a unit with the rail and resist outward canting of the rail in service.

The grip plates may be installed to serve primarily as rail anchors with four pairs of plates to the rail. However, it is the manufacturer's recommendation that they be used

The Grip Plates in Service

in greater numbers to take advantage of the positive grip of the plate on the rail as a means of securing greater stability of the rail on the ties by substituting the grip plates for the ordinary tie plates on every second, third or fourth tie, or, as has been suggested, that eight pairs of the grip plates be used to the rail, it being claimed that the rail will be prevented from canting, that the track will be held more closely to gage and that there will be less tendency for spikes to pull or work up. These grip plates are sold by E. L. Van Dresar, St. Paul, Minn.

A Good Magneto Is Essential to Successful Engine Operation

THE magneto on a gas engine is not usually made by the engine builder, and yet his reputation and the popularity of his engine must suffer for the sins of the magneto. He is, therefore, critical of its shortcomings, because they reflect unjustly upon his engine design. The ideal magneto must produce an adequate spark under all conditions that will be met in service, and that means low temperature, slow starting speed, dirty plugs, poor fuel—every obstacle that unfortunate circumstances, negligence, or inexpert handling can place in the way of igniting the gas in the engine cylinder. Because of this an account of the design and operation of the Type-OC magneto manufactured by the Wico Electric Company, Springfield, Mass., is of interest to the user of motor cars or other gas-engine operated equipment.

The Type-OC magneto uses a reciprocating armature that completely closes the magnetic circuit when the magnetism is thrown into the coils, and thus does away with air gap losses. This allows the magnets to work under the conditions of greatest efficiency, and consequently they do not require to be charged to such a high degree that they are constantly weakening. The general appearance of the magneto and its principle of operation can be seen in the three figures:

Figure 1 shows the driving bar (A), which is raised and lowered to operate the magneto by means of the eccentric on which the roller bears. The high tension current is generated by shifting the magnetism—supplied by the magnets (B)—into and out of the two coils (C), shown in Fig. 2. This shifting is done by the armature (D) which is moved back and forth by the action of the driving bar mentioned above.

The magnetism is shifted into the coils when the armature is held against the cores (E), by the return spring (F), and by the magnetic attraction of the cores. The armature remains in this position until the time for making the spark, which is produced by pushing the armature ⅛ in. away from the cores. This action whips the magnetism out of the coils, and discharges a high tension current through the spark wire.

In Fig. 1 some of the parts of the magneto that would obstruct the view of the moving parts have been left out in order to show more clearly the principle of operation. The armature slides on the guide rod (G) and gets its movement from the rocker arm (H) and the driving bar (A). As the eccentric turns, it carries the driving bar to the rocker arm and lifts it. This depresses the other end of the rocker arm and compresses the drive spring (I). At the proper time for making the spark, the end of the rocker arm reaches the end of the armature tube (J) and instantly breaks the magnetic contact between the cords and armature, which is snapped away from the cores by the compressed drive spring. When the armature is about ⅛ in. away from the cores the breaker points open (see Fig. 2) and the spark is made. As the eccentric continues to revolve, the pressure on the drive spring is relieved and the return spring lifts the armature back to the cores again.

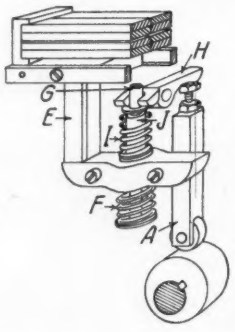


Fig. 1. How the Moving Parts Operate

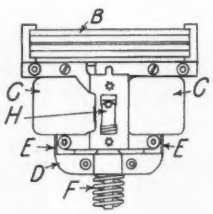


Fig. 2. The Back of the Magneto With the Case Removed

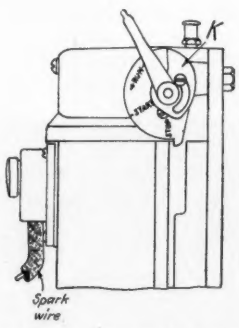


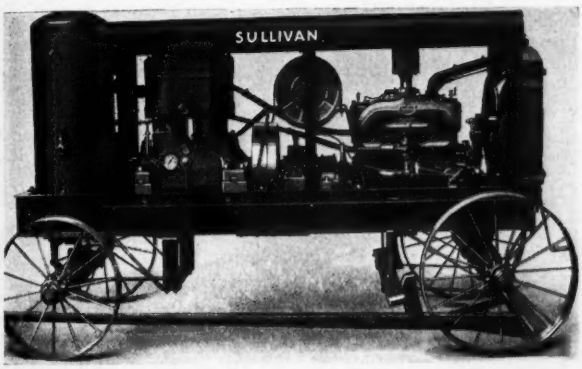
Fig. 3. The Spark Control

Figure 3 shows the parts used to shut off the spark and to advance or retard it to suit the speed of the engine. When the timing lever is pointing downward, the magneto will not make a spark because the armature is not tripped from the cores. The starting spark is made when the timing lever is set at the "start" mark. The spark is fully advanced when the timing lever is pointing directly upward. Few engines will require so much advance, and

the timing-lever-stop (K) is provided so that the engine maker can limit the spark advance to suit his engine. The starting spark is timed by setting the timing lever in the "start" position and adjusting the length of the driving bar so that the magneto trips when the piston has reached the end of its compression stroke.

A Portable Air Compressor Improved

THE Sullivan Machinery Company, Chicago, has made a number of changes in its portable gasoline engine driven compressors to increase the serviceability of this equipment for the variety of uses to which it is adapted. In redesigning, the capacity of the compressor has been increased to 170 cu. ft. displacement per min. This enables users to operate two rotater hammer drills at 100 lb. pressure simultaneously for holes up to 14 ft. in depth, if desired. A new transmission has also been provided, consisting of a simple gear reduction to cut down the engine speed to that more suitable for compressor operation. The Buda four-cylinder gasoline engine has been retained which furnishes the 31 hp. required to operate the compressor at full speed and at the same time leave



The Improved Sullivan Portable Gasoline Air Compressor

a substantial margin of power in the engine. Other improvements consist in strengthening the truck body and providing a steel canopy top and steel removable sides, where desired, so that the outfit can be thoroughly protected against unfavorable weather conditions or against tampering.

As improved, the equipment consists, in addition to the features mentioned, of a 170-ft. two-cylinder, vertical, single-acting air compressor with water jackets and water circulation, operated through gear and pinion by the Buda engine. This engine with the air receiver, gasoline tank and radiator is mounted on a steel truck, which is ordinarily mounted on wheels, but which can be mounted on skids or on a flat car. Lubrication is secured, as before, by a four speed oil pump enclosed in the crank case and arranged to deliver oil to all the bearings under a pressure of 15 to 20 lb. The use of the force feed lubrication instead of the common system of splash oiling is an important feature of this equipment since it avoids violent agitation of the oil and the entrance of any of the oil thrown off from the crank pins into the cylinder. Due to this system of lubrication the chief objection to vertical single acting compressors from an operating standpoint is said to have been met successfully. To maintain a constant air pressure the compressor is provided with an unloading appliance which automatically interrupts the pressure of air when the desired pressure is reached. This appliance maintains the air pressure within five pounds of the desired amount.

With the Associations

The Maintenance of Way Club of Chicago

Tie renewals will be the subject for discussion at the next meeting of the Maintenance of Way Club of Chicago, which will be held at the Auditorium Hotel, Chicago, at 6:30 p. m. on Wednesday, March 19. Three members of the club will discuss this subject from different standpoints, namely, how to determine what ties must be renewed, how the ties should be delivered and how the actual renewals should be made. This will be followed by a general discussion.

The Wood Preservers' Association

The Executive committee will meet in Chicago on March 11 to select subjects for investigation and report at the next convention and to determine the personnel of the committees. The members of the Executive committee will meet at dinner that evening with other members of the association who may be in attendance at the engineering convention.

The Bridge and Building Association

A canvass of the committees shows that all but two have already made marked progress in the preparation of their reports for presentation at the next convention, as a result of which it is estimated that the committee work as a whole is 50 per cent completed.

Arrangements have been made for the members of the association who will be in Chicago during the convention of the American Railway Engineering Association to meet at dinner at the Chicago Engineers' Club, 314 South Federal street, at six o'clock on Tuesday evening, March 11. The meeting will adjourn in sufficient time to enable those who desire to visit the exhibit at the Coliseum that evening.

The last copy for the annual proceedings is now in the hands of the printer and it is expected that these proceedings will be ready for distribution late in March.

The American Railway Engineering Association

All of the committee reports which are to come before the convention this month are in print and have been mailed to the members, the last one containing the report of the Committee on Wood Preservation and supplemental reports of the committees on Electricity and Iron and Steel Structures having gone into the mail about March 1. This bulletin also contains a special report on the Revision of the Classification of Accounts.

The membership of the association is now larger than at any previous time in its history, 150 applications having been received since January 15.

A special effort is being exerted to make the annual dinner this year unusually attractive, a special committee having been working on plans for several weeks.

The speakers will include Sir Henry Thornton, president of the Canadian National Railways; Fred W. Sargent, vice-president of the Chicago & Northwestern; and James Schermerhorn, humorist and former editor of the Detroit, Mich. Times.

The rapidity with which reservations for the dinner are coming in indicates that the capacity of the room will be taxed to the limit.

The following is the program and order of presentation of reports of committees of the American Raiway Engineering Association's annual convention, which will be held at the Congress Hotel, Chicago, on March 11-13, inclusive.

First Day, Tuesday, March 11

President's Address.
Report of Secretary and Treasurer.
Reports of Standing and Special Committees on
- Ballast
- Ties
- Buildings
- Wooden Bridges and Trestles.
- Signals and Interlocking
- Water Service
- Economics of Railway Location
- Uniform General Contract Forms
- Standardization.

Second Day, Wednesday, March 12

Reports of Standing Committees on
- Iron and Steel Structures
- Electricity
- Roadway
- Stresses in Railroad Track
- Shops and Locomotive Terminals
- Rail
- Track
- Yards and Terminals
- Economics of Railway Operation.

Annual dinner at 6:30 p. m.

Third Day, Thursday, March 13

Reports of Standing and Special Committees on
- Rules and Organization
- Signs, Fences and Crossings
- Masonry
- Records and Accounts
- Economics of Railway Labor
- Wood Preservation
- Co-operative Relations with Universities.

New Business. Election and Installation of Officers.
Adjournment.

Directory of Associations

American Railway Bridge and Building Association.—C. A. Lichty, secretary, C. & N. W. Ry., 319 North Waller Ave., Chicago. Next convention Kansas City, Mo. October 14-16, 1924. Exhibit by Bridge and Building Supply Men's Association.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn St., Chicago. Annual convention, Congress Hotel, Chicago, March 11-13, 1924. Exhibit by National Railway Appliances Association.

American Wood Preservers' Association—P. R. Hicks, secretary Room 1146 Otis Bldg., Chicago. Next convention, January 27-29, 1925, Chicago.

Bridge and Building Supply Men's Association.—John Nelson, secretary, Joseph E. Nelson & Sons, 3240 South Michigan Ave., Chicago. Exhibit in connection with annual convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers.—J. S. Penney, secretary, T. J. Moss Tie Company, St. Louis, Mo. Next convention, January 29-30, 1925, Chicago.

National Railway Appliances Association.—C. W. Kelly, secretary, Peoples Gas Bldg., Chicago. Annual exhibit at Coliseum, Chicago, in connection with convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—P. J. McAndrews, secretary, C. & N. W. Ry, Sterling, Ill. Next convention, Commodore Hotel, New York, September 16-18, 1924. Exhibit by Track Supply Association.

Track Supply Association.—W. C. Kidd, secretary, Ramapo-Ajax Corporation, Hillburn, N. Y. Exhibit in connection with convention of Roadmasters' and Maintenance of Way Association.

The Material Market

THE BEGINNING of any period of softening prices is marked by great secrecy, owing to the fact that any manufacturer who makes a concession in order to get business exerts every effort to avoid publicity concerning the details of the negotiations. This explains the present situation in the iron and steel market. There are evidences of some concessions in prices, both in structural steel and in track fastenings. In the case of the former these are sufficiently tangible to justify a record of them in the prices indicated below, but in the case of track supplies it is impossible to do so at this time. On the whole there is no general indication of a falling off of business. The softness in the structural steel market has taken place in spite of considerable new business, notable among which is the award of the contract for the Rigolets bridge of the Louisville & Nashville, involving 6,500 tons, to the American Bridge Company. Following are current prices on typical iron and steel items:

PRICES IN CENTS PER POUND

	January 20		February 20	
	Pittsburgh	Chicago	Pittsburgh	Chicago
Track spikes	$3.05 to $3.15	$3.10	$3.05 to $3.15	$3.10
Track bolts	4.00 to 4.25	4.20	4.00 to 4.25	4.10
Angle bars	2.75	2.75	2.75	2.75
Tie plaes, seel	2.55 to 2.60	2.60	2.60	2.60
Bat spikes	3.25 to 3.50	3.59 to 3.84	3.25 to 3.50	3.59 to 3.84
Plain wire	2.75	3.09	2.75	3.09
Wire nails	3.00	3.34	3.00	3.34
Barbed wire, galv.	3.80	4.14	3.80	4.14
C. I. pipe, 6 in. to 12 in., per ton		56.20		56.20
Plates	2.50	2.60	2.30 to 2.50	2.60
Shapes	2.50	2.60	2.40 to 2.50	2.60
Bars, soft steel	2.40	2.50	2.30 to 2.40	2.50
Rivets, structural	2.90	3.24	2.75	3.09
Reinforcing bars	2.40		2.40	2.40
Open hearth rail, per gross ton, f. o. b. mill				$43.00

A contrast is indicated by a comparison of the scrap market with the market for new material in that scrap prices have shown a moderately upward tendency during the past month, as indicated in the table below:

PRICES PER GROSS TON AT CHICAGO

	January	February
Relaying rails	$32.00 to $35.00	$27.50 to $32.00
Rails for rerolling	19.50 to 20.00	20.50 to 21.00
Rails less than 3 ft. long	20.50 to 21.00	22.00 to 22.50
Frogs and switches cut apart	18.50 to 19.00	19.50 to 20.00
Steel angle bars	19.50 to 20.00	20.50 to 21.00

While not manifest in the comparison of January and February lumber prices given below, there has been a well defined slowing up in the demand for lumber, which has been ascribed in the lumber journals to the fact that local stocks of lumber are now pretty well filled and dealers are waiting for a renewed demand before replenishing their stocks. This condition has been affected, no doubt, by the fact that the winter has been an unusually severe one, which has naturally curtailed building operation.

SOUTHERN PINE MILL PRICES

	January	February
Flooring, 1x4, B and B flat	$44.55	$46.20
Boards, 1x8, No. 1	39.15	37.10
Dimension, 2x4, 16, No. 1, common	26.60	29.20
Dimension. 2x10. 16, No. 1, common	28.55	28.95
Timbers, 4x4 to 8x8, No. 1	29.40	30.90
Timbers, 3x12 to 12x12, rough	38.70	42.25

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$31.00	$32.00
Boards, 1x8, 6 to 20, No. 1, common	19.50	19.50
Dimension, 2x4, 16, No. 1, common	18.50	19.50
Dimension, 2x10, 16, No. 1, common	18.50	19.50
Timbers, 6x6 to 8x8, No. 1, common	25.00	26.00
Timbers, 10x10 to 12x12, rough	25.00	25.00

No changes have been indicated in the prices of Portland cement and the table given below, showing quotations per barrel in carload lots, not including package, is the same as that published last month:

Chicago	$2.40	Albany	$2.32
Cincinnati	2.44	Buffalo	2.48
Davenport	2.33	New York	2.25
Minneapolis	2.42	Philadelphia	2.41
Pittsburgh	2.19	Richmond, Va.	2.47
Boston	2.63		

News of the Month

Radio was used by the Chicago & North Western in communicating with trains which were stalled in northern Wisconsin on February 5, when a heavy snow storm cut off all wire communication.

Revised figures on locomotive installations in 1923 show that 4,037 new locomotives were put in service. The number of locomotives reported owned at the end of December, 1923, was 64,896, while 510 locomotives were still on order and 14 locomotives were under construction in railroad shops.

The New York Central has installed motor trucks to handle less than carload freight on its Putnam division. Trucks now take freight from Yonkers, N. Y., on the main line to Dunwoodie, on the Putnam division, and to all stations north as far as Yorktown Heights, relieving local freights in this area.

A new American Museum of Safety was recently opened at 120 East Twenty-eighth street, New York City. The museum will be conducted in co-operation with the New York State Department of Labor, but will function as a national institution, where persons interested in safety may find, among other things, exhibits of the various devices being used in industrial plants, mines, railroads and public utilities to prevent accidents.

Every tenth man at the University of Illinois is learning about the problems of the railroads and the peculiarities and difficulties of railroad management, 700 students being enrolled in one or more of the courses in the department of transportation, which each year prepares more than 30 students for careers in traffic or operating departments on railroads. No other university or college, as far as known, has an entire department devoted to such training.

The most powerful single unit electric locomotive ever constructed is now in heavy slow speed freight service on the Pennsylvania. It weighs 516,000 lb. and is capable of exerting a starting tractive effort of 140,000 lb. At a speed of 20 miles an hour it is capable of producing continuously a tractive effort of 73,000 lb. The locomotive was built by the Pennsylvania at its Altoona works and was equipped by the Westinghouse Electric & Manufacturing Company.

The employees engaged in railway service on the Class 1 railroads of the United States in the month of November, the last month of record, numbered 1,899,545, according to reports submitted to the Interstate Commerce Commission. This is an increase of 79,082, or 4.3 per cent over the number reported for November, 1922. The total compensation shows an increase of 399,311, or 0.2 per cent over that for November, 1922. The number of employees reported for the first 11 months of the year 1923 averaged 1,887,590, which is an increase of 255,386, or 15.6 per cent, as compared with 1922, while the total compensation paid shows an increase of $386,990,898, or 16 per cent over the same period of 1922.

The freight traffic of the railroads of the United States in 1923, according to reports filed with the Bureau of Railway Economics, showed an increase of 2.3 per cent over the total for 1920, which marked the previous record year. Compared with 1922 the increase in ton miles was 21.7 per cent. A new high record was made in 1923 in the average daily movement per freight car, which averaged 27.8 miles per day, last year exceeding by 1.7 miles the best previous year, which was 1917, and also exceeding by 2.7 miles the average for 1920. Compared with 1922 it was an increase of 4.3 miles. The average load per freight car for 1923 amounted to 27.9 tons, which was an increase of one ton over the average for 1922, but a decrease of 1.4 tons from 1920, when the average was 29.3 tons.

Revenue freight car loadings continue to break all previous records for this time of the year. The total for the week ending February 2 was 929,936 cars, an increase of 64,522 cars, as compared with the corresponding week of last year, while 906,489 cars were loaded during the week ending February 9, or 57,137 more than the same week of 1923. Last year the 900,000 mark was not crossed until about the first of March. As compared with last year, increases were shown in the loading of all classes of commodities except coke and ore.

The fatalities at highway grade crossings for nine months ending with November, 1923, as reported by the Interstate Commerce Commission, numbered 1,616, as compared with 1,293 in the nine months of 1922, or an increase of almost 25 per cent. The total number of accidents to both trespassers and non-trespassers of all kinds resulted in 2,200 deaths, which is an increase of 21.9 per cent over the number during the same period of 1922, and 46,153 casualties, which is an increase of 35.4 per cent. The total number of train accidents amounted to 6,939, as compared with 5,195 in the same period of 1922. These accidents resulted in 164 deaths, as compared with 132 deaths in 1922, while the injuries amounted to 1,370, as compared with 1,914 during the same period of 1922.

Class I Railroads operating a total mileage of 235,667 miles earned a net operating income in 1923 of $977,543,590, or 5.1 per cent on their tentative valuation fixed by the Interstate Commerce Commission, plus additions and betterments up to January 1, 1923, according to complete reports for the year, filed with the commission and compiled by the Bureau of Railway Economics. In the Eastern district the rate earned with 5.4 per cent, in the Southern district 5.84 per cent and the Western district 4.57 per cent. The net operating income of the same roads was at the rate of 4.14 per cent in 1922. Of the total operating revenues for the year those derived from freight totaled $4,624,390,900, or an increase of 15.3 per cent over those for 1922, while the passenger revenues for the year totaled $1,147,751,691, or an increase of 6.6 per cent. Expenditures for maintenance of way and structures amounted to $821,380,867, an increase of $85,199,655, or 11.6 per cent over such expenditures in 1922.

The co-operative program which the International Association of Machinists, in collaboration with the Baltimore & Ohio System Federation and the Baltimore & Ohio railway management has been furthering relative to employee co-operation with industry, has been adopted as the official program of the six International Railroad Shopcrafts Unions, composing Section No. 2 of the American Federation of Labor. The program is one developed at the Glenwood, Pa., shops, where the federated shop crafts have assumed the responsibility for better shop service, improved methods of operation, increased production, reduced rates, greater safety and higher morale, all to be accomplished collectively through shop committeemen, local lodges, shop federations, councils of system and craft's officers and system federation general officers of the unions involved. The plan embodies the development of periodic joint conferences between the local management officers and regularly functioning local federated committees of the crafts concerned. The subjects considered at the total and system conferences are not grievances, working rules or wages, but rather ways and means

for bettering maintenance service, output, quality of work, etc. The adjustment of grievances, rules and wage matters is handled as in the past.

A 23 track bridge is being constructed over the Jackson river by the Chesapeake & Ohio, incident to terminal development work at Clifton Forge, Va. The new bridge is of a deck girder type of reinforced concrete and is to carry all of the 23 tracks of a new classification yard at that point. The structure will be 30 ft. high, 260 ft. long and 320 ft. wide and will require 7,200,000 lb. of steel. It will have two abutments and three piers of concrete on which will be placed steel girders to support concrete slabs two feet thick. The piers and abutments will require 26,000 cu. yd. of plain concrete masonry while the reinforced concrete slabs will require 3,500 cu. yd. of concrete.

A new plan to bring about the consolidation of the railroads into fewer and larger systems of approximately equal financial and competitive strength is proposed by Senator A. B. Cummins, former chairman of the Senate Committee on Interstate Commerce. in a bill introduced in the Senate on January 24. The bill represents study on the part of Secretary Hoover, as well as Senator Cummins, and is drafted with a view to affording stimulus to consolidations which is lacking in the present law. While the bill would re-enact the most important of the consolidation sections of the present act which authorizes the Interstate Commerce Commission to prepare a plan with which consolidations proposed voluntarily by the railroads must harmonize, it also affords more elasticity by authorizing the Commission to adopt and publish alternative plans and make more definite the provisions for modifications of the published plan. Provision is also made for the omission from the plan of terminal properties and for the common use of property by order of the Commission. The two outstanding features of the bill are the provision for a period of seven years after the passage of the act which is to be known as the period of voluntary action and then for a form of pressure intended to induce consolidations by authorizing the Commission to adjust the division of through rates within the incomplete systems so that each road shall have approximately the same surplus available for dividends in proportion to the value of its respective properties, thereby approaching as nearly as may be the condition which would exist if the roads were consolidated.

Track Awards on the Erie

The usual practice of the Erie railroad of awarding prizes to supervisors and section foremen whose subdivisions or sections show the most improvement after the season's work, was carried out for the working season of 1923. The prize awards ranged from $75 to $200. In addition to the cash prizes the winners have erected at suitable locations on their territories signs designating their rank. The banner section sign is painted white with black letters and the second prize section sign red with white letters. The appearance, cost and circumstances under which work was performed are taken into consideration when awarding prizes. Below is list of the prize award winners and the amounts they received for the season 1923 in other than the Chicago region, the awards in this region being published in the January issue, page 35.

Division	Name of Supervisor	Sub-Division	Rank	Amount
		New York Region		
Delaware	H. J. Weecheider	2	1	$200
Susquehanna	W. J. Flynn	2	2	100
Tioga	J. J. Leonard	1	1	100
		Special Prize—No Low Joints		
Terminal	M. Deniff	1	..	100
Terminal	P. Sobbott	2	..	100
New York	G. L. Dunn	3	..	100
Delaware	A. W. Wahl	1	..	100
Delaware	W. J. Weecheider	2	..	100
Tioga	J. J. Leonard	1	..	100
		Ohio Region		
Meadville	A. J. Bernard	1	1	200
Allegheny	W. H. Connolly	2	2	100
		Special Prize—No Low Joints		
Mahoning	C. Pierson	3	..	100
		Chicago Region		
Kent	N. E. Scribner	1	1	200
Marion	C. H. Staples	4	2	100
		Special Prize—No Low Joints		
Kent	N. E. Scribner	1	..	100

Personal Mention

General

F. D. Beale, division engineer on the Chesapeake & Ohio, with headquarters at Clinton Forge, Va., has been appointed assistant trainmaster with headquarters at Strathmore, Va. **A. M. Davidson** has been appointed assistant trainmaster and supervisor of track, with headquarters at Martin, Ky.

J. M. Egan, formerly a supervisor of track and more recently manager of the refrigerator department of the Car Service Division of the A. R. A., with headquarters at Chicago, has been appointed vice-president in charge of operation of the Missouri Pacific, with headquarters at St. Louis, Mo. Mr. Egan was born on September 1, 1880, at Amboy, Ill., and attended the De La Salle Institute, Chicago, from 1895 to 1898. He entered railway service in 1893 as a messenger on the Illinois Central and was later promoted to station agent. In 1898 Mr. Egan was appointed rodman in the maintenance of way department and in 1901 he was promoted to assistant engineer. He was promoted to supervisor in 1903 and to roadmaster in 1904. Mr. Egan was promoted to superintendent of the Mississippi division, with headquarters at Water Valley, Miss., in June, 1911, and in September, 1915, he was transferred to the Tennessee division. He was promoted to general superintendent of the Southern lines, with headquarters at New Orleans, La., in January, 1919, and remained in this capacity until March, 1923, when he was appointed chairman of the Chicago car service committee of the American Railway Association, with headquarters at Chicago. Mr. Egan was serving in this position at the time of his appointment as vice-president in charge of operation of the Missouri Pacific.

Henry D. Pollard, formerly an engineering and maintenance officer, and until recently headquarters at Savannah, Ga., has been promoted to the newly created position of general manager, with the same headquarters. Mr. Pollard was born on October 4, 1872, at Aylett, Va., and studied at the University of Virginia. In 1892 he entered railway service as a rodman on construction work with the Baltimore & Ohio and in 1893 was appointed assistant resident engineer of construction at Wellsville, Ohio, on the Ohio Southern, now a part of the Detroit, Toledo & Ironton. From 1894 to 1898 he was assistant engineer maintenance of way on the Philadelphia division of the Baltimore & Ohio; following which he was transitman on the Central of Georgia until 1900, when he was appointed resident engineer of construction. He subsequently served consecutively as supervisor of track, trainmaster and roadmaster until June, 1905, when he became superintendent at Macon, Ga. He was in Brazil from 1910 until 1913, when he reentered the service of the Central of Georgia as valuation engineer. In 1918 he was appointed assistant general manager of the Central of Georgia and during federal control was general manager. Two years later he was appointed general superintendent, which position he was holding at the time of his recent promotion to general manager.

Henry D. Pollard

Engineering

W. A. Greenleaf, roadmaster on the Tampa & Gulf Coast has been promoted to the newly created position of division engineer with headquarters at Tampa, Fla.

E. L. Hoopes, division engineer on the Pennsylvania System, with headquarters at Columbus, Ohio, has been transferred to Harrisburg, Pa.

C. D. Pollock, office and designing engineer of the Alaska Railroad, with headquarters at Anchorage, Alaska, has also been appointed acting bridge engineer, succeeding F. H. Chapin, who has resigned.

C. H. Mottier, office engineer of the Illinois Central, Chicago Terminal Improvements, with headquarters at Chicago, has been promoted to engineer of design, with the same headquarters, a newly created position.

J. M. Campbell, instrumentman on the Michigan Central, with headquarters at St. Thomas, Ont., has been promoted to assistant engineer, with the same headquarters, to succeed **C. R. Strattman,** who has been transferred to Jackson, Mich., where he fills a vacancy created by the resignation of **B. McNabb.**

A. F. Williams has been appointed assistant engineer on the Northwestern Pacific, with headquarters at Eureka, Cal.; **F. H. Gilman** has been appointed assistant engineer, with headquarters at Sausalito, Cal., and **Edward Zorn** has been appointed office manager in the office of the chief engineer, with headquarters at San Francisco, Cal.

R. E. Cahill has been promoted to division engineer on the Northern Kansas division of the Missouri Pacific, with headquarters at Atchison, Kan., to succeed **J. S. Bassett,** who has been appointed assistant division engineer of the Colorado division, with headquarters at Hoistington, Kan. **W. A. Matson** has been promoted to assistant engineer of the Wichita division, with headquarters at Wichita, Kan., succeeding **R. G. Bush,** who has been transferred to Kansas City, Mo.

F. L. Wonson, whose promotion to assistant chief engineer of the Missouri Pacific, with headquarters at St. Louis, Mo., was noted in the January issue, was born on July 1, 1877, at Gloucester, Mass. He studied engineering at Harvard, from which he graduated in 1899, and at the Massachusetts Institute of Technology, where he remained until 1901. He entered railway service in October, 1910, as an employee in the engineering department of the Missouri Pacific and was engaged as general bridge inspector until 1912, when he was promoted to assistant bridge engineer. He was promoted to bridge engineer on October 1, 1913, and continued in that capacity until his recent promotion.

G. H. Hicks, whose promotion to chief engineer of the Northwestern Pacific, with headquarters at San Francisco, Cal., was reported in the February issue, was born on May 11, 1884, at Savanna, Ill. He entered railway service in April, 1902, in the engineering department of the Chicago, Milwaukee & St. Paul, but in June, 1903, left for the Western Pacific, which was beginning preliminary surveys. He continued with that company until October, 1909, when he entered the valuation department of the Southern Pacific. His service with the Northwestern Pacific began in July, 1912, where he was successively promoted to assistant engineer, assistant valuation engineer, principal assistant engineer and acting chief engineer and valuation and property engineer, holding the latter position at the time of his promotion to chief engineer.

E. E. Oviatt, whose promotion to maintenance engineer of the Lines West, of the New York, New Haven & Hartford, was noted in the February issue, was born at New Britain, Conn., on July 13, 1891. He was graduated from the Sheffield Scientific School of Yale University in 1913, and entered railway service as a rodman in the engineering department of the New York, New Haven & Hartford on September 24, 1913, being promoted later to transitman. On May 1, 1915, he was promoted to assistant engineer on valuation work at New Haven and on March 1 of the following year was transferred to the Boston division with headquarters at South Braintree, Mass. On May 20, 1917, he was promoted to division engineer of the Old Colony division at Taunton, Mass., subsequently serving in the same capacity on the Danbury division and the Central New England at Danbury, Conn., and on the New Haven division with headquarters at New Haven, Conn., until his recent promotion to maintenance engineer.

C. J. Geyer, division engineer on the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to assistant superintendent maintenance of way, with the same headquarters. **S. H. Pulliam,** formerly supervisor of track on the Baltimore & Ohio, has been appointed division engineer to succeed Mr. Geyer. **T. H. Greene,** supervisor of track, with headquarters at Russell, Ky., has been promoted to division engineer, with headquarters at Clifton Forge, Va., succeeding **F. D. Beale,** appointed assistant trainmaster, with headquarters at Strathmore, Va. **Charles J. Geyer** was born at Zanesville, Ohio, on April 6, 1889. He entered railway service in the construction department of the Grand Trunk Pacific in May, 1908, leaving that road in 1909, to enter the employ of the Chesapeake & Ohio, where he served as a rodman and later as an instrumentman in the maintenance department on the Richmond, Huntington and Cincinnati divisions until 1913, when he was promoted to assistant engineer on the Richmond division. In 1914 he was transferred to the valuation department, remaining in this position until 1918, when he was promoted to division engineer, with headquarters at Richmond, Va., the position which he held at the time of his recent promotion to assistant superintendent maintenance of way. **S. H. Pulliam** was born at Richmond, Va., on November 20, 1894. He entered railway service as an axeman in the engineering department of the Baltimore & Ohio in January, 1912, where he subsequently served as rodman and inspector until July, 1916, when he was promoted to assistant supervisor of track. In March, 1918, he was promoted to assistant division engineer, remaining in this position until March, 1920, when he joined the Van Blarcom Company at Cleveland, Ohio. Later he entered real estate business in that city. In January, 1922, he returned to railway service as a supervisor of track on the Baltimore & Ohio, which position he held at the time of his recent appointment as division engineer on the Chesapeake & Ohio.

Thomas H. Greene was born at Richmond, Va., on July 17, 1897, and received his engineering education at the Virginia Polytechnic Institute. Excluding some summer vacation railway work, Mr. Greene entered railway service in February, 1917, as a rodman in the engineering department of the Chesapeake & Ohio, being later promoted to transitman. In January, 1918, he was transferred to the chief engineer's office as a draftsman, where he remained for a short time and then returned to field construction work, where he served until February, 1921, when he was promoted to assistant engineer in the maintenance of way department. In August, 1923, he was promoted to supervisor of track, which position he was holding on the Russell Terminal division, with headquarters at Russell, Ky., at the time of his recent promotion to division engineer at Clifton Forge, Va.

Thomas H. Greene

F. P. Turner, whose promotion to principal assistant engineer of the Norfolk & Western was announced in the February issue, was born near Christiansburg, Va., in 1875 and is a graduate in mechanical engineering of the Virginia Polytechnic Institute. He entered railway service for the first time in 1899, when he was engaged for three months as a chainman on the Norfolk & Western. He was an instrumentman and draftsman on the Virginia Southwestern at Elizabethtown, Tenn., from 1899 to 1901, and thereafter was employed as masonry inspector until 1903, when he was promoted to assistant engineer on construction. He served for 3½ years as assistant engineer on bridge, viaduct, tunnel and general double track construction in the West Virginia mountains, after which he was occupied for 2½ years in

charge of construction and for 4½ years in charge of the construction of bridges and double track in Ohio. He was promoted to bridge engineer in 1913, and continued in this capacity until his recent promotion.

E. E. Hart, chief engineer of the Nickel Plate district of the New York, Chicago & St. Louis, with headquarters at Cleveland, Ohio, has been appointed consulting engineer, with the same headquarters. **W. J. Bergen,** valuation engineer of the system, has been appointed chief engineer of the Nickel Plate district, with headquarters at Cleveland, Ohio, in addition to his duties as valuation engineer.

Mr. Hart was born on September 18, 1861, at Little Valley, N. Y. He was graduated from Cornell University in 1887 and entered railway service in June of that year as a draftsman on the Chicago, Burlington & Quincy. He was subsequently promoted to assistant engineer and division engineer. In 1895 he left railway service to engage in general engineering practice, returning to railway service in July, 1899, as division engineer of the Eastern division of the New York, Chicago & St.Louis. In November of that year his jurisdiction was extended over the entire system and he continued in this position until 1906, when he was promoted to chief engineer. Mr. Hart was serving in this position at the time of his recent appointment as consulting engineer.

Daniel Hubbard, whose promotion to division engineer of the Chicago division on the Chesapeake & Ohio, with headquarters at Peru, Ind., was reported in the February issue, was born on November 24, 1888, at Orange, Va., and educated at the Baltimore Polytechnic Institute. He entered railway service in 1905 and until 1907 was successively transitman and resident engineer for the Bolivia Railway Company, in Bolivia. In 1908 he was resident engineer on the Chattahoochee Valley railroad at West Point, Ga., holding this position until 1909, when he left railway service to engage in irrigation work in Colorado. From 1910 to 1911 he was transitman and field engineer in the construction department of the Baltimore & Ohio and from 1911 to 1914 he held the position of assistant engineer, assistant division enginee, division engineer and construction engineer on the Autofagaste & Bolivia railroad in Bolivia. In 1915 he was assistant engineer for the Survey Commission, Baltimore, Md. He returned to the Baltimore & Ohio in 1916 and until 1920 was employed as assistant supervisor, assistant division engineer and division engineer maintenance of way, leaving the service of the Baltimore & Ohio in August, 1920. Until January, 1921, he was then employed as assistant general manager of the Wherle Company, Newark, Ohio, and from the latter date until August, 1923, was division engineer in the highway department for the state of Ohio. He entered the service of the Chesapeake & Ohio in September, 1923, and until January, 1924, was employed as assistant engineer, which position he held at the time of his recent promotion.

Daniel Hubbard

Track

O. Anderson, assistant roadmaster on the Oregon Short Line, has been promoted to roadmaster at Los Angeles.

William A. Bracken has been promoted to assistant roadmaster of the Seattle division of the Northern Pacific, with headquarters at Seattle, Wash.

F. R. Applegate has been promoted to roadmaster on the Cincinnati, Indianapolis & Western, with headquarters at East Springfield, Ill., to succeed **Joseph McKeown,** who has resigned after 40 years of service with the company.

Joseph Gagne has been appointed roadmaster on the Canadian Pacific, headquarters at Farnham, Que., Canada, succeeding **George McKeddie** who has retired.

W. F. Farlow, roadmaster on the Chicago, Burlington & Quincy, with headquarters at Wymore, Neb., was recently placed on the pension roll after 44 years of service.

John D. Keiley, assistant engineer on the staff of the superintendent maintenance of way of the Chesapeake & Ohio, with headquarters at Richmond, Va., has been promoted to supervisor of track with headquarters at Russell, Ky.

D. B. Clark, roadmaster on the Florida East Coast, with headquarters at St. Augustine, Fla., has been promoted to general roadmaster, a newly created position, with the same headquarters. The position of engineer of roadway has been abolished. **E. W. Sellars,** assistant roadmaster has been promoted to roadmaster of the Northern division with headquarters at St. Augustine. **W. E. Robinson** has been appointed roadmaster of the Southern division with headquarters at Miami, Fla.

T. L. Scott, formerly roadmaster on the Southern Pacific, has been appointed roadmaster on the International-Great Northern, with headquarters at Navasota, Tex., to succeed **N. G. Rich.** At an earlier date **E. M. Sparks** was appointed roadmaster at Trinity, Tex., to succeed **D. C. King.** Mr. Sparks was formerly in the employ of the International-Great Northern and since that time has served as general roadmaster on the Vera Cruz & Pacific railway in Mexico, also as superintendent of construction in charge of double tracking on the Great Northern in Montana. At one time he had charge of construction work on the National Railways of Mexico.

W. H. Haggerty, whose promotion to supervisor of track on the New York, New Haven & Hartford, with headquarters at Hartford, Conn., was announced in the February issue, was born at Bridgeport, Conn., on November 17, 1896. He received his engineering education at Brooklyn Polytechnic Institute, following which he entered railway service as a timekeeper in the division engineer's office of the New York, New Haven & Hartford at Stamford, Conn., on February 2, 1914. He was promoted to assistant foreman in July, 1915, and subsequently to work train foreman on November 14, 1916, with headquarters at Stamford, remaining in this position until his recent promotion to supervisor of track at Hartford.

C. E. Price has been promoted to track supervisor on the Alabama Great Southern (a subsidiary of the Southern), with headquarters at Chattanooga, Tenn., to succeed **L. B. Hancock,** who has been assigned to other duties. **B. Porrell** has been promoted to track supervisor, with headquarters at Birmingham, Ala., to succeed **C. C. Roberson,** who has been assigned to other duties. **J. M. Walley** has been promoted to track supervisor on the south end of the New Orleans & Northeastern and the New Orleans Terminal Company (properties of the Southern), with headquarters at New Orleans, La., in place of **E. Smith,** who has been transferred to Laurel, Miss., to succeed **J. B. Tillman,** who has been assigned to other duties. **J. R. Williamson** has been promoted to track supervisor on the Birmingham division of the Southern and also as track supervisor of the Ensley Southern, with headquarters at North Birmingham, Ala.

David B. Clark, whose promotion to general roadmaster of the Florida East Coast is mentioned elsewhere in these columns, was born at Spout Springs, N. C., on June 13, 1873. He entered railway service as a bridge laborer on the South Florida railway in August, 1893; where he was subsequently promoted to assistant bridge foreman and bridge foreman. In November, 1897, he was appointed a section foreman, remaining in this position until November of the following year, when he became a track laborer on the Florida East Coast. In February, 1899, he was promoted to section foreman and in September, 1904, to work train foreman, serving in this capacity until April of the following year, when he was promoted to track supervisor. In April, 1910, he was

promoted to acting roadmaster and in September of the same year to roadmaster with system jurisdiction and headquarters at St. Augustine, Fla., which position he was holding at the time of his recent promotion to general roadmaster.

Albert H. Smyth, whose appointment to roadmaster of the Idaho division of the Northern Pacific, with headquarters at Kootenai, Idaho, was reported in the January issue, was born on January 1, 1889, in North Dakota, and was educated at the North Dakota State College. He entered railway service in the engineering and construction department of the Northern Pacific in January, 1907, where he remained until March, 1918. From March, 1918 to December, 1919, he was employed by a contracting firm as assistant superintendent on railroad construction, and from January, 1919 to February, 1923, was general foreman on various highway and tunnel construction projects. He returned to the Northern Pacific in February, 1923, being appointed roadmaster at Kootenai, Idaho.

William E. Robinson, whose promotion to roadmaster on the Florida East Coast is mentioned elsewhere in these columns, was born at Pittsburg, Kan., on June 24, 1894. He entered railway service as a chainman in the engineering department of the St. Louis-San Francisco in Sepembter, 1909, where he was subsequently employed as a draftsman and instrumentman until May, 1917, when he left railway work to serve with the U. S. Army as an officer in the Engineer corps. In February, 1920, he was discharged from military service and resumed railway work as an assistant engineer maintenance of way on the St. Louis-San Francisco, leaving this road in March of the same year to become assistant engineer on the Florida East Coast, with headquarters at St. Augustine, Fla., which position he was holding at the time of his recent promotion to roadmaster.

M. T. Dearden, whose promotion to roadmaster on the Union Pacific, with headquarters at Rawlins, Wyo., was reported in the January issue, was born on January 25, 1897, at Henefer, Utah. He entered railway service on April 1, 1913, as a section laborer on the Union Pacific, which position he held until November, 1913. He was again employed as section laborer on the same road from February 1, 1916 to May 1, 1916, when he was promoted to material clerk on work trains. From August 1, 1916 to November 1, 1916, he was derrick operator, and on November 8, 1916, was promoted to section foreman on the Park City branch of the Union Pacific. On June 17, 1917, he was transferred to a main line section and on July 15, 1921, was promoted to extra gang foreman on the Western division. He was promoted to assistant roadmaster on April 20, 1923, with headquarters at Granger, Wyo., the position he was holding at the time of his recent promotion to roadmaster of the Western division.

N. A. Schutz, who has been promoted to supervisor of track on the New York, New Haven & Hartford, was born at Norwich, Conn., on October 19, 1891. He was graduated from the Connecticut State College in 1910 and in June, 1911, he entered railway service as a rodman on the Central New England. With the exception of a short period in 1912 he remained with that road as rodman, draftsman and later transitman until April, 1914, when he left railway service. In June, 1916, he returned to the employ of the Central New England as a transitman, remaining in this position until July, 1917, when he left the railroad to become plant engineer for the New England Slag Company. In February, 1918, he again returned to railway service as a draftsman on the New York, New Haven & Hartford at New Haven, being transferred in October of the same year to Maybrook, N. Y., as general foreman on construction where he remained until April, 1920, when he was promoted to assistant engineer at Danbury, Conn. In June, 1922, he was promoted to assistant supervisor of track at Poughkeepsie, N. Y., the position he held at the time of his promotion to supervisor of track.

J. H. Cooper, division engineer on the Pennsylvania System, with headquarters at Harrisburg, Pa., has been appointed supervisor of track with headquarters at New York, succeeding **E. R. Parke** transferred to the Williamsport division. **Gustave Evert,** acting supervisor on the Logansport division of the Northwestern region, with headquarters at Logansport, Ind., has been promoted to supervisor, to succeed **J. M. Winger,** pensioned. **Claud B. Bush,** assistant supervisor, with headquarters at Derry, Pa., has been promoted to supervisor on the Pittsburgh division, with headquarters at South Fork, Pa. Mr. Bush was born on October 7, 1890, at Denver, Colo., and was educated at Washington and Lee University. He entered railway service on July 20, 1916, on the Pennsylvania, as an assistant in the engineering corps, with headquarters at Cleveland, Ohio, holding this position until September, 15, 1917. From that date until June 1, 1919, he was in military service, and from June 1, 1919, to November 1, 1922, he was again an assistant in the engineering corps of the Pennsylvania, at Cleveland. He was assistant supervisor at Derry, Pa., from November 1, 1922, until his recent promotion.

C. H. Craig, whose promotion to roadmaster on the Chicago, Burlington & Quincy, with headquarters at Orleans, Neb., was reported in the January issue, entered railway service in October, 1897, as a section laborer on the Chicago, Burlington & Quincy, at Dunning, Neb. He continued in this capacity until May, 1906, when he was promoted to section foreman at Dunning, where he remained until April 1, 1912, when he was promoted to extra gang foreman, later becoming section foreman at Broken Bow, Neb. On November 15, 1912, he entered the service of the Union Pacific as a section foreman at Rogers, Neb., and when the Union Pacific installed motor cars on their sections in 1913, he was made assistant foreman, later maintaining signals. From February, 1919 to December, 1, 1915, he was a section foreman on the Burlington, leaving on the latter date to engage in other business. He re-entered the employ of the Chicago, Burlington & Quincy in February, 1919, as a section foreman, which position he held until April 1, 1919, when he was transferred to Aurora, Neb. From the spring of 1920, to December, 1920, he was extra gang foreman, when he was again made section foreman. He was with a steel gang in 1921, and on July 1, 1922, was promoted to assistant roadmaster on the Lincoln division, which position he held until March, 1923, when he was again made section foreman, later having charge of a steel gang until August, 1, 1923, when he was promoted to roadmaster on the Wymore division. In the latter part of September, he became section foreman, which position he held at the time of his recent promotion.

Bridge and Building

F. Cornelius, water service foreman on the Colorado division of the Union Pacific, has been promoted to general water service foreman of the Los Angeles division.

C. S. Duncan has been promoted to assistant supervisor of bridges and buildings on the Los Angeles & Salt Lake, with headquarters at Salt Lake City, Utah, to succeed **R. R. Bishop,** who has been promoted to supervisor, with the same headquarters.

John M. Anderson, whose appointment as general water service foreman of the Salt Lake division of the Los Angeles & Salt Lake, with headquarters at Salt Lake City, was reported in the January issue, was born on November 4, 1884, at Cedar Valley, Utah. He entered railway service in October, 1901, as pumper at Cedar Fort, Utah, and assistant pumper at Lehi, Utah, on the Oregon Short Line, which position he held until December 20, 1903, when he entered the service of the San Pedro, Los Angeles & Salt Lake (now the Los Angeles & Salt Lake), as assistant pump repairer and well driller. He was later promoted to water service foreman, doing construction work, well drilling and considerable concrete work. He continued in the service of the water service and bridge and buiding departments from 1903 until his recent promotion to general water service foreman of the Salt Lake division.

Purchases and Stores

F. S. McClung, general storekeeper of the Texas & Pacific, with headquarters at Marshall, Tex., has been promoted to

purchasing agent, with headquarters at Dallas, Tex. **J. S. Matthias** has been appointed general storekeeper, with headquarters at Marshall, Tex., succeeding Mr. McClung.

R. C. Vaughan, director of purchases and stores of the Canadian National, has been appointed vice-president in charge of purchases and stores.

Incident to the concentration of purchasing and stores department activities at Philadelphia, **W. W. Morris,** purchasing agent of the Northwestern region of the Pennsylvania, with headquarters at Chicago, and **C. E. Walsh,** assistant purchasing agent of the Central region, with headquarters at Pittsburgh, Pa., have been appointed assistant purchasing agents, with headquarters at Philadelphia, Pa. **W. G. Phelps,** purchasing agent of the Central region, with headquarters at Pittsburgh, Pa., has been appointed assistant purchasing agent, with the same headquarters. **A. E. Owen,** assistant to the purchasing agent of the Northwestern region, with headquarters at Chicago, has been promoted to assistant purchasing agent, with the same headquarters. **C. R. Peddle, purchasing** agent of the Southwestern region, with headquarters at St. Louis, Mo., has been appointed assistant purchasing agent, with the same headquarters. **G. W. Snyder,** general storekeeper of the Eastern region, with headquarters at Philadelphia, Pa., has been appointed assistant to the stores manager, with the same headquarters. **R. C. Harris,** general storekeeper of the Central region, with headquarters at Pittsburgh, has been transferred to Philadelphia, Pa. **O. V. Daniels,** assistant general storekeeper of the Eastern region and **S. I. Gowland,** assistant general storekeeper of the Central region, have been transferred to Philadelphia. **W. F. Vogt,** works storekeeper, with headquarters at Altoona, Pa., has been promoted to general storekeeper, with the same headquarters. **C. W. Kinnear,** general storekeeper of the Northwestern region, with headquarters at Chicago, and **W. L. Oswalt** have been appointed assistant general storekeeper, with headquarters at Altoona.

Mr. Owen was born on March 27, 1880, at Camden, N. J. He entered railway service in April, 1896, in the department of the auditor of passenger receipts of the Pennsylvania at Philadelphia. He was transferred to the purchasing department in June, 1899, and in 1914 was detailed to represent the purchasing department with Messrs. Gibbs and Hill, consulting electrical engineers, who were constructing the Philadelphia, Paoli and Chestnut Hill electrification. In 1917, Mr. Owen was appointed chairman of a committee which took over the management and supplying of commissaries of labor camps on the Pennsylvania lines east of Pittsburgh and Buffalo, and in 1919 he was promoted to equipment agent. He was appointed assistant to the purchasing agent of the Northwestern region, with headquarters at Chicago, in March, 1920, and continued in that position until his recent promotion to assistant purchasing agent.

Obituary

J. W. Kendrick, formerly chief engineer of the Northern Pacific and recently chairman of the board of the directors of the International-Great Northern, with headquarters at Chicago, died in that city on February 16. Mr. Kendrick was born on October 14, 1853, at Worcester, Mass., and was graduated from the Worcester Polytechhnic Institute in 1873. He entered railway service in 1878 as a levelman on the construction of the Yellowstone division of the Northern Pacific, and was engaged in the location of the Yellowstone and Missouri River divisions until 1880. In that year he was promoted to engineer in charge of construction of the Yellowstone and Missouri River divisions and he continued in this position until 1883, when he was promoted to chief engineer of the St. Paul & Northern Pacific, now a part of the Northern Pacific. Mr. Kendrick was promoted to chief engineer of the Northern Pacific in 1888, and in July, 1893, he was promoted to general manager. In February, 1899, he was elected vice-president in charge of operation and he held this position until June, 1901, when he was elected vice-president in charge of operation of the Atchison, Topeka & Santa Fe. He resigned this position in June, 1911, to establish a private practice as consulting engineer at Chicago. Upon the reorganization of the International-Great Northern in December, 1922, Mr. Kendrick was elected chairman of the board of directors and he continued in that position until his death.

W. A. Bowden, chief engineer, Department of Railways and Canals of Canada, died on February 3, at Ottawa.

H. Kinzie, supervisor bridges and buildings on the New York, New Haven & Hartford, recently died at his home in Taunton, Mass.

E. R. Foster, roadmaster on the Slaten division of the Atchison, Topeka & Santa Fe, with headquarters at Slaten, Tex., was killed on February 13, when run over by a special train en route to the scene of a boiler explosion near Lubbock, Tex.

Dr. P. H. Dudley, consulting engineer on rails, tires and structural steel on the New York Central, with headquarters at New York City, originator of the Dudley rail section and one of the outstanding figures in the development of railway engineering science, died on February 26 in that city. Dr. Dudley was born on May 21, 1843, at Freedom, Ohio, and was educated at Franklin Institute. He received the degree of Ph. D. from Hiram College (Ohio) in 1907. Dr. Dudley's first position of any prominence was that of chief engineer of the city of Akron, Ohio, which he held from 1868 to 1872, following which he became chief engineer of the Valley Railway of Ohio. In 1878 he was employed as expert for the Eastern Railroad Association, a position which led to his connection with the New York Central as consulting engineer of rails, tires and structural steel. Among his many inventions are the dynamometer car, developed in 1874, the track indicator, developed in 1880, and the stremmatograph for obtaining and registering strains in rail under moving trains. Dr. Dudley is credited with the development of the first five-inch rail used in the United States, which he designed in 1883, and with the first six-inch 100-lb. rail, which he introduced in 1892. He is the originator of the Dudley rail section and is also credited with making the first announcement, in 1884, that fungi are the cause of decay in wood. Dr. Dudley was reporter for American railroads at the sixth session of the International Railway Congress at Paris in 1900, on the "Nature of the Metal for Rails," and again at the seventh session held in Washington in 1905, on "Rail for Lines with Fast Trains." In December, 1902, he stated seven fundamental principles deducted from stremmatograph studies, illustrating the American railway theory and practice with reference to the action of locomotives and rolling stock on rails and roadbed. He has also contributed to the development of mining engineering. He was a member of the Society of Arts (London), of the American Museum of Natural History, of the American Institute of Mining Engineers and of the American Railway Engineering Association.

Dr. P. H. Dudley

The Southern Pacific has recently placed in service 10 new locomotives for hauling its heavy passenger trains between Los Angeles, Cal., and El Paso, Tex., which are especially designed for this long run of 815 miles over difficult mountain and business territory which is to be made without changing locomotives, thus establishing a new record for long locomotive runs. It is anticipated that these locomotives will average about 12,000 miles per month. The locomotives have a total weight of 368,000 lb., of which 246,000 lb. are on the eight driving wheels.

Construction News

The Atchison, Topeka & Santa Fe plans the construction this year of a new bridge across the Canadian river at Canadian, Tex. Appropriation has also been made for a double track bridge across the Mississippi river at Fort Madison, Iowa, for which plans are now being prepared.

This company plans the construction of a storehouse at Dodge City, Kan., to cost approximately $65,000, also a new passenger station and shop additions at Cleburne, Tex., and additions to its shops at Emporia, Kan. This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of sub-structures for terminal facilities at San Bernandino, Cal., reported in the December issue.

This company is calling for bids for the construction of an express building at Dodge City, Kan.

This company has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the erection of a boiler washing plant at Dodge City, Kan.

This company has awarded a contract to Jerome A. Moss, Chicago, for the laying of a 20-in. suction pipe line in the Mississippi river at Fort Madison, Iowa, to cost approximately $70,000.

This company plans the construction of 16 miles of third track from Emporia, Kan., to Ellinor, and six miles of third track to Emporia eastward.

This company will construct additional passing tracks and industrial tracks at Corcoran, Cal., at an estimated cost of $25,000.

This company has awarded a contract to the Missouri Valley Bridge & Iron Works, Leavenworth, Kan., for the construction of the substructure for the extension of its bridge across the South Canadian river at Canadian, Tex., at an estimated cost of $500,000.

This road has included the following new construction in its improvement program for 1924: Grade separation and the construction of viaducts in Los Angeles county, Cal., which will cost $2,250,000; a warehouse, 40 ft. by 550 ft., at Fourth street and Santa Fe avenue, Los Angeles, at a cost of $210,000; additional storage and switch track at Hobart, Cal., at a cost of $105,000; extension of storage and switch tracks at Corcoran, Cal., and Hanford, at a cost of $11,500 and $25,000, respectively; and a steel water tank of 50,000 gallons capacity, at Ash Fork, Ariz., costing $7,000.

The Beaver, Meade & Englewood has been authorized by the Interstate Commerce Commission to construct a 39.2 mile extension from Forgan to Hooker, Tex.

The Canadian National has authorized the construction of improvements to the station approaches at Vancouver, B. C., at a cost of $100,000.

The Canadian Pacific has authorized the reduction of grade between Field, B. C., and Golden.

This company plans the construction of the following improvements and extensions in 1924: Additions to terminal facilities at Outlook, Sask., and Wynyard; additional yard and passing tracks at Fort Garry, Man.; Austin; Virden; Minnedosa and Johnston; Bredenbury, Sask.; Antler; Tuxford and Cluny; Kirkpatrick, Alta.; Knee Hill Milk River; Spring Coulee; New Dayton; Calgary; Coleman and Banff; extensions to roundhouses at Outlook, Sask. and Wynyard; new power plant at Winnipeg, Man.; passenger stations at Lac du Bonnet, Man., and Balmoral; Gainsborough, Sask.; Inslow; Sparling, and Govan; Kirkaldy, Alta.; Chin and New Dayton; and steel water tanks at Winnipeg, Man., and Medicine Hat; Piapot, Sask., and Odema.

The Chicago & North Western contemplates the relocation of its tracks through Whitefish Bay, Wis.

The Chicago, Burlington & Quincy called for bids during the month for the construction of a five-stall addition to its roundhouse at Edgemont, S. D., and for a five-stall addition to its roundhouse at Denver, Colo. This company is also calling for bids for the construction of an addition to its hotel and eating house at Cody, Wyo.

The Chicago, Rock Island & Pacific, jointly with the Atchison, Topeka & Santa Fe, the Chicago, Burlington & Quincy and the City of St. Joseph, Mo., will construct a steel and concrete viaduct over the tracks at South Sixth street in St. Joseph. The viaduct will be 370 ft. long and will cost approximately $175,000.

The Chicago, Indianapolis & Louisville has awarded a contract to Thompson & Binger, Indianapolis, Ind., for the construction of a freight station at Indianapolis, reported in the January issue, and will elevate its tracks from East street to Alabama street, in Indianapolis, Ind., this year at a cost of $150,000.

The Cleveland, Cincinnati, Chicago & St. Louis contemplates the construction of an addition to its roundhouse at Sharonville, Ohio. Plans for the extension have not been made nor has its construction been definitely authorized.

The Erie is installing a Hulett ore unloading machine at Cleveland, Ohio.

The Great Northern plans the construction of a 30-stall roundhouse at Troy, Mont., and also a brick passenger station and the elevation of its tracks over Third street in that city.

The Illinois Central will construct a coaling station at Springfield, Ill., with company forces.

This company has recently secured a reaffirmation of the original decision of the Interstate Commerce Commission, authorizing the Southern Illinois & Kentucky and the Chicago, St. Louis & New Orleans, subsidiaries of the Illinois Central, to construct lines in Illinois and Kentucky, forming, with already existing facilities, a line from Edgewood, Ill., to Fulton, Ky., 169 miles. The Illinois Central was also authorized to acquire control of and to operate the line.

The International-Great Northern will construct a 1,200-car freight yard at Houston, Tex., and will increase the capacity of the Booth yard in that city. A roundhouse, to cost $150,000, will be constructed at San Antonio, Tex.

The Louisville & Nashville plans the construction of a roundhouse and shops at Whitesburg, Ky. This company will construct with company forces a two-story office building and an enginehouse at New Orleans, La., at an estimated cost of $300,000, and has awarded a contract to Platoff & Bush, Louisville, Ky., for the construction of a one-story machine shop at Etowah, Tenn., as reported in the February issue.

The Long Island has applied to the New York Transit Commission for an order requiring the elimination of 22 grade crossings on its Atlantic avenue division between Flatbush Avenue Station, Brooklyn, and Jamaica, Queens, New York City. Under the law half of the expense would be borne by the railroad and one-fourth each by the municipality and state. There is now available $500,000 of state funds for this purpose—permitting work to cost $2,000,000, but the total cost of eliminating all the crossings is estimated by the Transit Commission at $11,000,000 if the railroad tracks are elevated or $40,000,000 if they are depressed.

The Marshall, Elysian Fields & Southeastern has received authority from the Interstate Commerce Commission for a 10 mile extension from Elysian Fields to Lorraine, Tex.

The Minneapolis, Northfield & Southern is preparing plans for the construction of a seven-mile spur from Oxboro, Minn., to the Ford plant at South St. Paul, including a bridge over the Mississippi river, at an approximate cost of $750,000.

The Minarets & Western plans the construction of a one-story enginehouse and repair shop at Pinedale, Cal.

The Minneapolis, St. Paul & Sault Ste. Marie will construct a 900-ft. extension to its ore dock at Ashland, Wis., at a cost of approximately $1,250,000. A contract has been awarded to Whitney Brothers Company, Duluth, Minn., for the erection of the substructure.

The Mississippi Southern, through the Edward Hines Yellow Pine Trustees, has applied to the Interstate Commerce Commission for a modification of the certificate issued for this road some time ago so as to permit the construction of an extension from Kiln to Pass Christian, Miss., 14½ miles.

The Missouri-Kansas-Texas is planning the construction of a car repair shop at Denison, Tex., at a cost of $175,000.

This company has awarded a contract to the Bellows Maclay Construction Company, Dallas, Tex., for the construction of a seven-story concrete warehouse at Dallas, reported in the February issue.

The Missouri Pacific has awarded a contract to Jerome A. Moss, Chicago, for the construction of a passenger station at Crane, Mo. This company has completed its plans and will soon call for bids for the construction of a one-story brick passenger station at Newport, Ark., and contemplates the construction of a union station at Texarkana, Ark. No plans for the building have yet been prepared.

This company is calling for bids for the construction of an addition to its store house at Ewing avenue, St. Louis, Mo.

The New York, Chicago & St. Louis contemplates the construction of second track from Claypool, Ind., to Knox, a distance of 40 miles. Surveys are now being made, but the work has not yet been authorized and it has not been determined when bids will be requested.

The Pacific Fruit Express contemplates the construction of car repair shops and a power house at Roseville, Cal., at an approximate cost of $150,000, including machinery.

The Panhandle & Santa Fe plans the construction of additional yard tracks and the extension of the existing tracks, including the placing of several crossovers, at Lubbock, Tex., at an estimated cost of $35,000. The work will be done by company forces.

The Pennsylvania will rebuild its roundhouse and shops at Valparaiso, Ind., which were damaged by fire on January 17, with a reported loss of $25,000. This company is reported as planning the construction of an office building and two freight houses at Cincinnati, Ohio, and jointly with the Erie and Baltimore & Ohio, plans the construction of a union passenger station at Akron, Ohio.

The Prescott & Northwestern have received authority from the Interstate Commerce Commission to construct a 26-mile line from Prescott, Ark., in an easterly and southerly direction.

The Pueblo Conservancy District, through the Dayton-Morgan Engineering Company, Dayton, Ohio, has awarded contracts for the construction of flood control works at Pueblo, Colo. A contract has been awarded to Platt Rogers, Inc., Pueblo, for the construction of 33 miles of railroad track, for channel excavation aggregating approximately 1,000,000 cu. yd. of earth, and the construction of a concrete barrier dam in Rock Canyon. A contract has been awarded to Cole Brothers, Green Bay, Wis., for additional channel excavation, involving the removal of 54,000 cu. yd. of earth, and for the construction of a railroad embankment and several levees. A contract has been awarded to A. S. Hall & Son, Colorado Springs, Colo., for the construction of the sub-structures of two railroad bridges and for the construction of a re-inforced concrete bridge. A contract has been awarded to the Virginia Bridge & Iron Company, Roanoke, Va., for the fabrication and delivery of four 100-ft. double track, through riveted truss spans. A contract has been awarded to the Mt. Vernon Bridge Company, Mt. Vernon, Ohio, for two 200-ft. double-track steel bridge spans. Contracts have been awarded to the Strobel Steel Construction Company, Chicago, and the Pueblo Bridge & Construction Company, Pueblo, for the erection of the two bridges. A contract has been awarded to William Olson, Pueblo, for the construction of the embankment of Rock Canyon barrier dam, involving 90,000 cu. yd. of earth fill.

The Reading has awarded to the McLean Contracting Company, Philadelphia, a contract for the erection of the substructure for a bridge to carry the tracks of the Atlantic City Railroad over Clinton avenue, Oaklyn station, New Jersey The company has also awarded contracts respectively to the Frederick Snare Corporation and the McClintic-Marshall Company, both of Philadelphia, for the substructure and the superstructure for the reconstruction of a bridge over its Plymouth branch, at Conshohocken, Pa.

This company has awarded a contract to the Curtis-Grinrod Company, Philadelphia, covering the furnishing and erection of a store and oil house at Wilmington, Del. This structure will be a one-story reinforced concrete and brick building, 32 ft. by 84 ft. 3 in., with concrete platforms, concourse, ramp and steps, material to be furnished by the contractor.

This company has awarded contracts in connection with the construction of its passenger terminal at Camden, N. J., to the Marine Docking & Supply Company, Philadelphia, for magnesite composition flooring, base and wainscoting; to Martin & Breen, Inc., Philadelphia, for asphalt flooring, and to Richmond & Kemp, Philadelphia, for the furnishing and erection of glazed steel and iron gate partitions between the ramp and train platforms.

The St. Louis-San Francisco will reconstruct with company forces, its passenger station at Lebanon, Mo., recently damaged by fire with a loss of $20,000, and plans the construction of a freight and passenger station at Neodesha, Kan., to cost $50,000.

This company is calling for bids for the construction of a brick passenger station at Bristow, Okla.

The Southern has awarded a contract to John P. Pettyjohn & Company, Lynchburg, Va., for the construction of a repair shop at Ferguson, Ky., reported in the February issue.

The Southern has awarded a contract to the Dwight P. Robinson Company, New York, for the construction of a locomotive and car shop at Birmingham, Ala. The shop will be of the transverse type and will include an erecting shop, 80 ft. by 568 ft.; a machine shop, 95 ft. by 468 ft.; a boiler shop, 100 ft. by 240 ft.; a blacksmith shop, 100 ft. by 260 ft.; a forge shop, 30 ft. by 80 ft.; a flue shop, 50 ft. by 80 ft.; a power house, 80 ft. by 90 ft.; a storehouse and office, 55 ft. by 200 ft.; a paint shop, 24 ft. by 60 ft.; a tank shop, 100 ft. by 158 ft.; a firing-up shed, 45 ft. by 100 ft., and a wash and locker building, 42 ft. by 128 ft.

The Southern Pacific has awarded a contract to the Utah Construction Company, San Francisco, for the construction of an additional 11 miles of the Natron cut-off from Oakridge, Ore., to Summit. A contract has also been awarded to the Stewart & Welch Company, Seattle, Wash., for an additional seven miles of line.

This company has been ordered by the Public Service Commission of Oregon to construct a freight station at Oregon City, Ore, construction of which is to be undertaken at once, and has awarded a contract for the construction of a passenger station at Redlands, Cal., reported in the October issue. The estimated cost of the building is $75,000.

This company contemplates the construction of a brick shop building and roundhouse at Jacksonville, Tex. Plans for the structures have not yet been made.

This company will construct a passenger station at Jeanerette, La., with company forces.

The Spokane, Portland & Seattle plans the construction of a brick and concrete passenger station at Astoria, Ore., at a cost of $70,000.

The Union Pacific closed bids for the construction of a three-story brick passenger station, 82 ft. by 372 ft., at Ogden, Utah. This company plans the construction of additions to its engine terminal at East Yard, Los Angeles, Cal., at an estimated cost of $150,000. The plans call for a one-story shop building, 40 ft. by 300 ft., another shop building, 40 ft. by 100 ft., and an 11-stall roundhouse.

This company has completed plans for the construction of an 18-mile extension from Fort Collins, Colo.

The Wyoming North & South has applied to the Public Service Commission of Wyoming for permission to construct an extension to the Billy Creek, Wyo., oil fields.

Equipment and Supplies

The Chicago & North Western has ordered 35,000 tons of rails from the Illinois Steel Company, 5,000 tons from the Inland Steel Company and 6,000 tons from the Bethlehem Steel Company.

The Canadian Pacific has order 50,000 tons of rails from the Algoma Steel Company.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 4,000 tons of rails from the Inland Steel Company and 4,700 tons from the Illinois Steel Company.

Supply Trade News

General

The Sullivan Machinery Company, Chicago, has moved its Birmingham, Ala., office to 2108 Fifth avenue, North.

The Pawling & Harnischfeger Company, Milwaukee, Wis., is planning to construct a one-story brick and steel foundry at Milwaukee, Wis.

The Ingot Iron Railway Products Company has been organized with offices at 1318 Peoples Gas Buildnig, Chicago, for the development and promotion of the sale of Armco corrugated culverts in the railway field.

The Morden Frog & Crossing Works, Chicago, will construct a 100-ft. by 240-ft. extension to its main shops, and a new saw mill 88-ft. by 64-ft., at a cost of $100,000, including new machinery, at Chicago Heights, Ill.

The Railway Equipment Company, composed of **R. E. Bell** and **W. H. Reeves,** 584 Arcade building, St. Louis, Mo., has been appointed to handle the business of the **National Lock Washer Company,** of Newark, N. J., in southwestern territory, effective February 4.

The Inland Steel Company has changed the name of the Milwaukee Rolling Mill Company which it has recently purchased to the Inland Steel Company of Wisconsin. **C. A. Irwin,** president of the Milwaukee Rolling Mill Company, will be president of the Inland Steel Company of Wisconsin.

The McVicker Railclamp Tieplate Company has been incorporated with headquarters at 221 Grand avenue, Milwaukee, Wis., and with $1,000,000 capital stock, to manufacture rail anchor tie plates as the successor to the Railway Safety Tie Company. The company has purchased a plant at Winthrop Harbor, Ill., which it will equip with machinery. **E. M. McVicker** is president, **A. M. Masters** is vice-president and **J. E. Radke** is secretary.

The Chipman Chemical Engineering Company, New York, has started its new arsenic reduction works at Martinez, on San Francisco Bal, Cal., producing refined white arsenic from ores shipped in to the plant from various points in California and Nevada. The new plant consists of an initial installation comprising a crushing plant, McDougal 7-hearth roaster, and arsenic kitchens. The arsenic plant was designed by Ralph N. Chipman, president of the company, and Charles R. Wraith of the Anaconda Copper Mining Company.

The Blaw-Knox Company, Pittsburgh, Pa., has adopted an extended payment plan available to all purchasers of its line of standard steel buildings, which is designed to simplify the financing of projects for the construction of shops, warehouses and other industrial structures. The standard terms under the building-finance plan provide for a 10 per cent payment with the order and 23⅓ per cent on delivery, with the balance payable in monthly installments over a period of one year. Companies that prefer to buy buildings outright as heretofore are accorded a cash discount of five per cent.

The Blaw-Knox Company, Pittsburgh, Pa., has reorganized its sales organization. **Robert C. Harris** has been transferred from the New York office to Baltimore as district sales manager. **Walter H. Duncan,** formerly field engineer for **John F. Casey Company,** contractors, has been appointed representative of the road equipment department. **William F. Glasser,** formerly engineer in the heavy forms department, has been promoted to assistant chief engineer. **Charles K. Wehn** has been transferred from Chicago to the Pittsburgh office as district manager of the standard steel building department. **R. D. Spradling** has been transferred from Baltimore to become district manager of the standard building department at Chicago. **Dan W. Healy** will remain in New York as district sales manager of the standard building department in that city.

The Kalman Steel Company, Chicago, has purchased the Corrugated Bar Company of Buffalo, manufacturers of steel reinforcing bars. The plants of the Corrugated Bar Company are located at Hammond, Ind., Buffalo, N. Y., Boston, Mass., Philadelphia, Pa., and Atlanta, Ga. The offices of the Kalman Steel Company will be moved to the Wrigley Building, Chicago, on March 22. **Paul J. Kalman,** president of the Kalman Steel Company, will be president of the reorganized Kalman Steel Company. **George E. Routh, Jr.,** vice-president of the Kalman Steel Company, will be vice-president of the reorganized company. **J. A. Cathcart,** assistant vice-president of the Kalman Steel Company, and **A. E. Pinard,** treasurer of the Kalman Steel Company, will remain in those capacities. **A. P. Clark,** general manager of sales of the Corrugated Bar Company, has been elected general manager of sales for the Kalman Steel Company, and **W. S. Thomson,** chief engineer of the Corrugated Bar Company, will have the same position with the Kalman Steel Company. **L. O. Helgensen,** eastern sales manager of the Kalman Steel Company, with headquarters at New York, will retain the same position.

Personal

L. H. Welling has been appointed manager of the eastern office of the **Graver Corporation,** East Chicago, Ind. Mr. Welling's headquarters are at New York City.

J. T. Stephenson has been appointed eastern sales representative for the Woolery Machine Company, with headquarters at 1128 Munsey building, Washington, D. C.

M. S. Hovey, vice-president in charge of manufacturing of **Fairbanks, Morse & Co.,** with headquarters at Chicago, has been appointed vice-president and general manager with the same headquarters.

H. E. Hughes, vice-president of the **Locomotive Crane Company of America,** Champaign, Ill., has been elected president, succeeding Charles Bergan, resigned. He will be succeeded by **John Brenza,** a director.

M. K. Trumbull has joined the organization of **Flint & Company, Inc.,** Corn Exchange building, 25 Broad street, New York, as associate and consultant in connection with the activities of this company in making industrial investigations and surveys, appraisals, cost findings, etc.

James S. Ervin, formerly in charge of the sale of mineral rubber and special asphalts of the **H. H. Robertson Company,** Pittsburgh, Pa., manufacturers of Robertson process asbestos protected metal skylights, ventilators, etc., has been appointed manager of sales, with headquarters at Pittsburgh, to succeed C. D. Mercer, who has resigned.

G. E. Geer, who has had charge of the railroad sales of the **Wyoming Shovel Works** in its Chicago office for many years, has resigned to become vice-president of the **William H. Ziegler Company,** Minneapolis, Minn., distributors of Wyoming shovels in that territory. **Stanley H. Smith** now has charge of the Chicago territory of the Wyoming Shovel Works, in addition to his former territories, with the title of director of railroad sales. Mr. Smith was for many years manager of railroad sales for the Bethlehem Steel Company.

N. B. Norris, New Orleans, La., district manager of the **Pawling & Harnischfeger Company,** Milwaukee, Wis., has been appointed district manager of the Memphis, Tenn., office. **D. J. Murphy** of the New Orleans office has been appointed district manager of the Texas district, with headquarters at Dallas, Tex. **F. W. Truex** will continue as district manager at Atlanta, Ga., with office at 212 Haas-Howell building, and **W. J. Dugan** as southern sales manager will assume charge of the entire southern territory, with headquarters at Memphis.

E. F. Kultchar, district maintenance engineer on the Chicago, Burlington & Quincy, with headquarters at Galesburg, Ill., has resigned to join the Ingersoll-Rand Company, with headquarters at Chicago. After attending the University of Illinois, Mr. Kultchar entered the service of the Chicago, Burlington & Quincy as a rodman in the engineering department in 1906, and subsequently served in this department in various capacities on location, construction and maintenance as instrument man, resident engineer and division engineer until March, 1916, when he was transferred to the operating department as a roadmaster. He was promoted to trainmaster in June, 1917, and in October, 1921, to maintenance engineer for the Illinois district, which position he was holding at the time of his recent resignation.

A. D. Graves

J. B. Bouck, Jr.

F. W. Robinson

At a recent meeting of the board of directors of **Pratt & Lambert, Inc.**, Buffalo, N. Y., **A. D. Graves** was elected senior vice-president and treasurer; **J. B. Bouck, Jr.**, was elected vice-president in charge of the eastern division at New York City and **F. W. Robinson** was elected vice-president in charge of manufacturnig. The following officers were re-elected: **J. H. McNulty**, president; **J. N. Welter**, vice-president in charge of the western division; **H. E. Webster**, secretary. A. D. Graves entered the service of Pratt & Lambert, Inc., in 1908, as a salesman; ten years later he became manager of trade sales. In January, 1921, he was promoted to general manager and now becomes senior vice-president and treasurer. J. B. Bouck, Jr., began service with Pratt & Lambert, Inc., in 1893, as office boy. He subsequently served successively as salesman, assistant resident manager and resident manager. In 1917 he was appointed secretary-treasurer of the company and has now been elected vice-president in charge of the eastern division, with headquarters at New York City. F. W. Robinson began work with Pratt & Lambert, Inc., at its New York plant in 1896; he subsequently served as general superintendent and now becomes vice-president in charge of manufacturing.

Pierce Lewis, of the advertising department of the **Truscon Steel Company**, with headquarters at Detroit, Mich., has been promoted to advertising manager, with headquarters at Youngstown, Ohio, succeeding S. M. Fechheimer, who has resigned to entèr private business.

Hugh B. Holmes, chief engineer of the Pittsburgh & West Virginia from 1920 to 1923, has entered private practice as a consulting engineer, with offices at 1711 First National Bank building, Pittsburgh, Pa., where he will specialize in reports on properties and projects. Mr. Holmes was chief engineer of the Kansas City, Mexico & Orient from 1913 to 1917 and thereafter was associated with Coverdale & Colpitts, consulting engineers, New York, until he became chief engineer of the Pittsburgh & West Virginia in 1920.

Hobart Ames, for nearly 23 years president of the Ames Shovel & Tool Company, Boston, Mass., has resigned and **Alfred C. Howell**, who was for many years connected with the Bethlehem Steel Company, has been elected as his successor, effective February 15. Mr. Ames will remain as one of the directors, but intends to devote more of his time to his private interests and will no longer act as the chief executive of the company. Mr. Howell's connection with the steel industry extends over a long period of years, he having served in various responsible positions in Bethlehem, Philadelphia, Cincinnati and Pittsburgh with the Bethlehem, Midvale and Carnegie steel companies and for a few years as manager of the steel department of the W. Bingham Company, Cleveland, Ohio.

William R. Hillary, formerly division engineer of the Grand Rapids division of the Pennsylvania System, with headquarters at Fort Wayne, Ind., has been appointed sales engineer of the **National Lock Washer Company**, with headquarters at Newark, N. J. Mr. Hillary was born on May 1, 1877, at Philadelphia, Pa., and graduated from the University of Pennsylvania in 1897. He entered railway service on December 8, 1897, as assistant on engineering corps on the Pennsylvania Lines West of Pittsburgh and on April 1, 1902, was promoted to assistant division engineer on the same lines. From July 1, 1906, to December 31, 1912, he was division engineer and on the latter date was promoted to supervising engineer. On March 1, 1920, he became engineer maintenance of way of the Lines West of Pittsburgh, which are now a part of the Pennsylvania System, and on March 16, 1921, was appointed division engineer of the Toledo division, with headquarters at Toledo, Ohio, later being transferred to the Grand Rapids division, which position he resigned late in 1923.

Trade Publications

Pre-Cast Concrete Highway Crossings.—The Portland Cement Association, Chicago, has issued an eight-page leaflet outlining approved practices in the construction of pre-cast concrete highway grade crossings. A detailed line drawing illustrates the construction of the crossing in full, while a number of photographs show actual installations and the methods of construction. In addition to brief descriptions, the text includes a condensed specification for the making of the concrete and instructions for installing the slab in the tracks.

Vitrified Brick Pavement.—The National Paving Brick Manufacturers' Association, Cleveland, Ohio, has issued a 92-page book illustrating and describing the proper method of constructing brief pavements under a wide variety of conditions and uses. The subject is treated in a logical order, taking into account the foundation, base, curbing and all other features making up the pavement and the book is illustrated with a large number of views of pavements and roadways throughout the country. While the book is devoted primarily to city streets and public roads the information is of value to anyone who has occasion to use brick in pavements or roadway for any purpose.

Pumps.—Leaflets have been prepared by the United Iron Works, Inc., describing with illustrations the Pomona and the No. 10 Pomona special double stroke deep well power pumps, also the Sterling mechanical systems of refrigeration for cold storage plants, drinking water systems and ice making plants. The leaflets develop the main features of the equipment described, furnish dimensions, and include line drawings showing the method of installation.

Cold Repair Cement.—A small size, 16-page, illustrated booklet has been issued by the Barber Asphalt Company, Philadelphia, Pa., containing specifications for the construction of railroad grade crossings and station platforms by means of cold repair cement manufactured by this company. The text matter of the booklet gives the various requirements for the construction of new crossings and the repairing of old, as well as the detailed procedure to be followed in carrying out this work.

MOTOR CARS
HAND AND PUSH CARS
VELOCIPEDES
STANDPIPES
PUMPS
OIL ENGINES
ELECTRIC MOTORS
SCALES
COALING STATIONS
SAND AND CINDER PLANTS
WATER STATIONS

INCLUDING ENGINEERING SERVICE
AND COMPLETE CONSTRUCTION

FAIRBANKS, MORSE & CO., Inc.

Chicago

Branches in Principal Cities

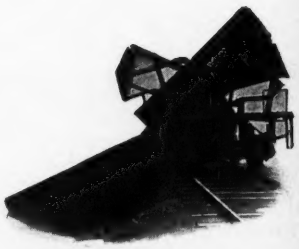
An Ideal Air Dump Car For Railroad Use.

The attention of Railroad Men is called to the new Western 20-yard Automatic Air Dump Car, fitted with the Western Extension Floor or Apron. Western automatic cars of any size can be fitted with this apron for throwing the load away from the ballast but the 20-yard car usually is preferred for Ditching.

The Western 20-yard car with Apron is ideally adapted to the exacting requirements or railroad work:—is dependable; throws the load beyond the ballast; economically operated; low upkeep costs.

May we help along your investigations? Blue prints are not enough. Their performance record tells the story.

Western That's Why



Western 20-yard Automatic Air Dump Car With Extension Floor or Apron.

WESTERN WHEELED SCRAPER COMPANY

Founded 1877

Earth and Stone Handling Equipment

Aurora, Illinois

MULE-HIDE "NOT A KICK IN A MILLION FEET" ROOFING AND SHINGLES Reg U.S. Pat. Office

LONG-LIFE

The products bearing this trademark are made in such a way as to give satisfactory service over the longest possible period of time.

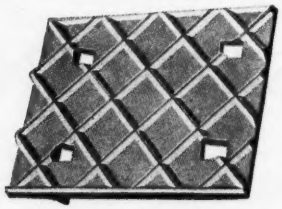
Quick replacement is never necessary when you buy asphalt roofing, shingles and insulating materials bearing this trademark.

THE LEHON COMPANY

Manufacturers,

CHICAGO, ILLINOIS

Sellers Anchor Bottom



Wrought Iron Tie Plates

Efficient
- Hold track to gauge
- Seat square to the rail
- Do not injure the tie
- Stop season checks in tie
- Bottom ribbing is a truss equal to one sixteenth inch additional solid section

Durable
- **Rolled end over end**
- **Never break**
- **Made of Wrought Iron—corrosion retarded**

Made in all sizes—with level or tapered rail seat, and with or without crown or cambre

SELLERS MANUFACTURING COMPANY

McCormick Building, Chicago, Ill.

The Proof

SHOWN above is one of a number of successful fire resisting tests made by a large and important railway system of the central west.

This wooden structure, typical of bridge construction, after receiving one coat of CLAPP'S FIRE RESISTING PAINT withstood raging flames that after thirty minutes burned out leaving the timber only slightly charred.

Convincing proof of the remarkable fire resisting properties of this paint.

ONE coat of CLAPP'S FIRE RESISTING PAINT will both preserve the timber and protect it against fire loss for a period of from five to eight years.

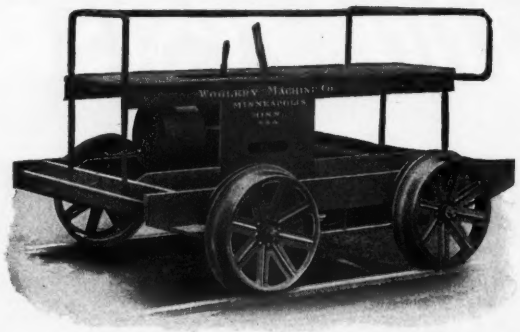
This longer service life given all wooden structures is not only the most economical method of wood preservation but the actual saving in many cases has been greater than the initial cost of the paint.

Write for further proofs.

THE CLAPP FIRE RESISTING PAINT CO.
BRIDGEPORT, CONN.

WOOLERY BALL BEARING
RAILWAY MOTOR CARS

DEPENDABLE



REVERSIBLE

PATENT APPLIED FOR

STRENGTH—Chrome Nickle Steel Ball Bearing Axles have double the working strength of common, mild steel axles. Selected Hickory frame, with Channel Steel Sub-Sills arranged in Truss form, gives the greatest possible strength with the least weight.

POWER—Woolery Ball Bearing Engines rated from 5 to 15-H. P. and developing 40% more than their rating supply, steady, dependable power to efficiently handle the heavy work required of present day Motor Cars.

SAFETY—The greatest care has been given to the development, design, and application of Safety Devices. Deep Tool Trays, Hand Railing, Pipe Lift Handles, Band Brake, Ample Guards, High Wheels and Low Car Floor all contribute to safety.

BALL BEARING ENGINES AND RAILWAY MOTOR CARS, PUSH CARS, POWER DECKS, AXLES

See Our Exhibit at Space 204, Coliseum, March 10-13

WOOLERY MACHINE CO., 2919 Como Ave., Minneapolis, Minn.

The margin of safety

There is a margin of safety provided for in the operation of signals.

Block joint insulation must posess an equal safety factor to ensure utmost dependability.

Practical railway signalmen find this margin of safety in Diamond Fibre.

Diamond Fibre has unusually high dielectric strength and remarkable wearing qualities. It is dense and tough. It stands excessive pressure and vibration. It is readily workable.

For other special conditions, where exceptionally high electrical properties are essential, use Celoron.

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Write today for quotations and samples of Diamond Fibre and Celoron.

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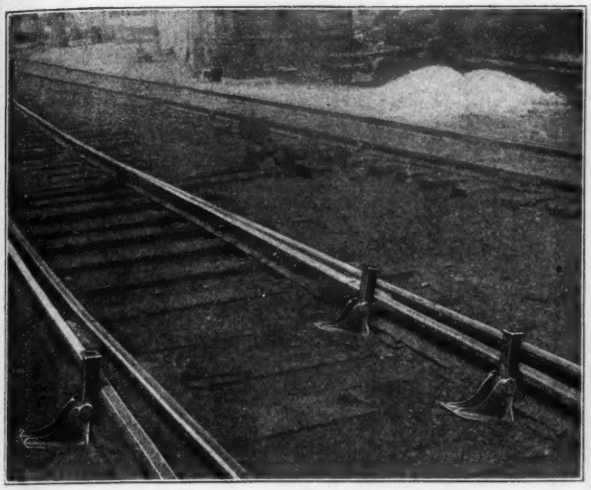
Specialists in the Design and Manufacture of

Standard— Insulated— Compromise Rail Joints

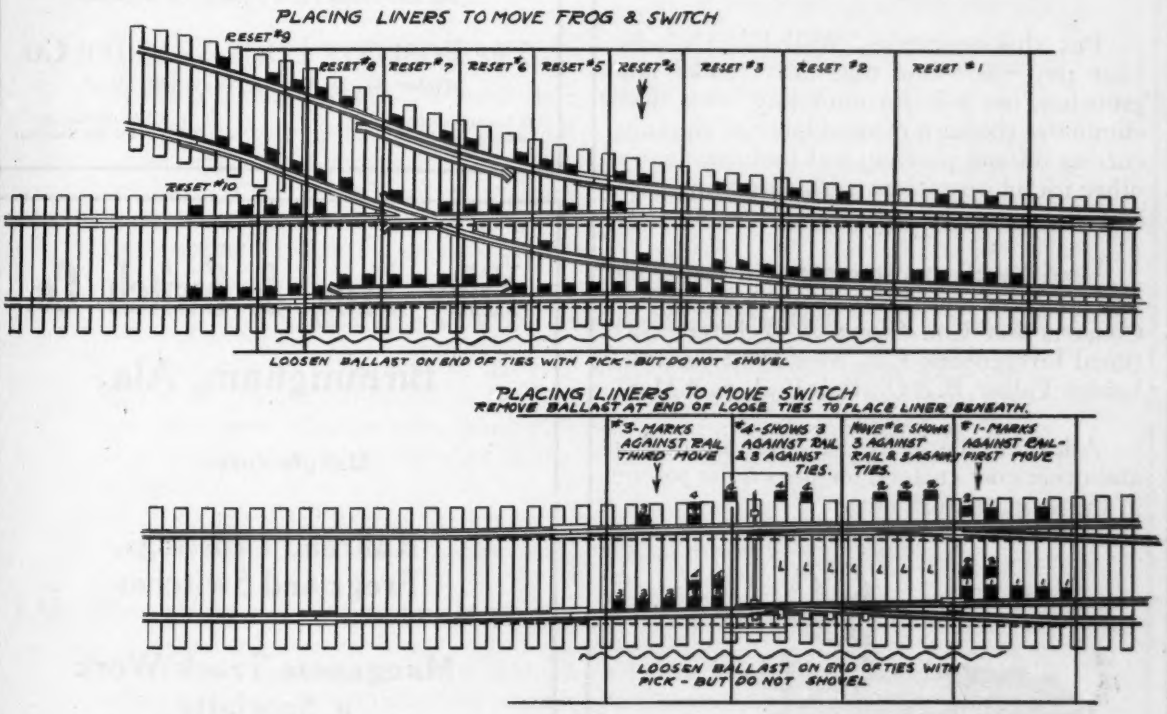
The Rail Joint Company
61 Broadway New York City

Lining Frogs and Switches



Position of Idol Track Liners in Lining a Switch.

Lining a Switch with Idol Track Liners.


PLACING LINERS TO MOVE FROG & SWITCH
RESET #9
RESET #8
RESET #7
RESET #6
RESET #5
RESET #4
RESET #3
RESET #2
RESET #1
RESET #10
LOOSEN BALLAST ON END OF TIES WITH PICK - BUT DO NOT SHOVEL
PLACING LINERS TO MOVE SWITCH
REMOVE BALLAST AT END OF LOOSE TIES TO PLACE LINER BENEATH.
#3-MARKS AGAINST RAIL THIRD MOVE
#4-SHOWS 3 AGAINST RAIL & 3 AGAINST TIES.
MOVE #2 SHOWS 3 AGAINST RAIL & 3 AGAINST TIES.
#1-MARKS AGAINST RAIL-FIRST MOVE
LOOSEN BALLAST ON END OF TIES WITH PICK - BUT DO NOT SHOVEL

In placing liners to move frog and switch each reset involves a replacement of the liners. Follow positions as indicated in order—Reset 1, Reset 2, etc.—moving rails gradually to positions indicated by dotted lines.

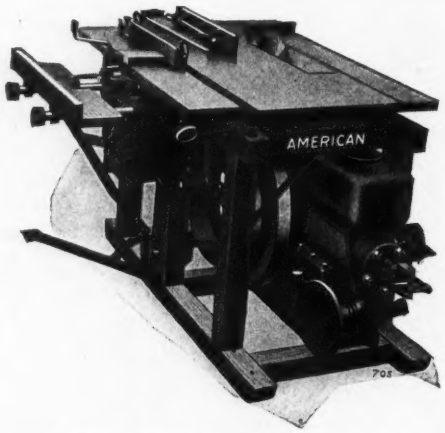
Idol Track Liner will be shown at the exhibit of the National Railway Appliance Association, Coliseum, Chicago, Ill., March 10th to 13th inclusive, Booth 225.

THE IDOL TRACK LINER COMPANY

434 South Wabash Avenue, CHICAGO

THOS. D. CROWLEY & CO., Sales Agents, 122 So. Michigan Ave., Chicago

AMERICAN COST CUTTERS

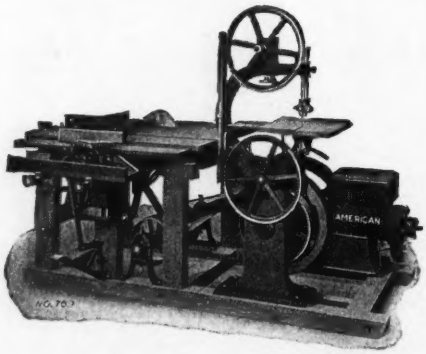


Portable Woodworker With Power Built In

Put this energetic "WORKMAN" on your pay roll. One that never sulks, nor grouches, nor asks for more pay. One that eliminates the hard manual labor of ripping, cutting-off and planing, and performs many other useful operations with surprising ease and dispatch.

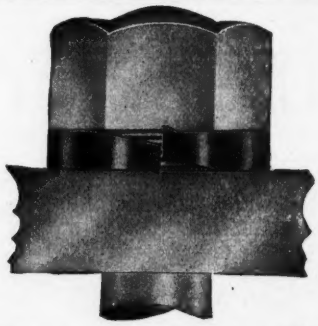
Used by the most prominent construction concerns and railroads, such as Turner Construction Co., Stone & Webster, National Fireproofing Co., New York Central, Lehigh Valley, B. & O., P. & R., L. S. & M. S.

Ask for Bulletin No. 80, describing this and other cost cutters, for use on the job or in the shop or work car.



Portable Woodworker With Band Saw

American Saw Mill Machinery Co.
164 Main Street Hackettstown, N. J.



The Positive Lock Washer

Holds *Tight* — Whatever Happens

Once drawn up tight, a bolted assembly equipped with Positive Lock Washers *remains tight.* No amount of jarring will loosen it; vibration only makes the bolts tighter.

For absolute insurance against loose bolts, use Positive Lock Washers.

Write for Catalog.

We Also Make Plain Type Lock Washers

***The* POSITIVE LOCK WASHER CO.**
Miller St. & Ave. A, Newark, N. J.

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H. L. Van Winkle, Agt.
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Kilby Frog & Switch Co.

Birmingham, Ala.

Manufacturers of

Railroad Crossings, Frogs and Switches

Manganese Track Work a Specialty

Balkwill Cast Manganese Articulated Crossings

Graham Flange Frogs

(The Savers of Maintenance)

Better Rail Joint Insulation Means Lower Maintenance Costs

In every insulated rail joint renewal there are two factors of cost:

1—The cost of the new fibre, and
2—The labor cost of the replacement

On trunk line systems using 100-lb. rail, each joint renewal costs, at a conservative estimate, at least $5.00. Of this amount, approximately $3.00 is for the fibre and $2.00 for labor. On many roads the labor cost is higher.

The **DETERMINING** factor is the cost, therefore, is **the wearing quality of the insulating fibre.**

In the development for rail joint insulation of

WHALL'S *Special Railroad* FIBRE

primary consideration always has been given to the production of a touch, resilient, shock-and-weather-resisting product that would be less liable to crush out of joints in wet weather and last longer under all conditions.

This development, covering practically the entire use of automatic signaling, began with the fabrication in 1886 of the first hard fibre ever used for rail joint insulation—for the Old Colony Railroad (now operated by the N. Y., N. H., & H. R. R.)—and has advanced steadily with each increase in rail weight and each improvement in signal system construction.

Specified for ALL Renewals

That renewal fibres must be the very highest grade—even better than required for the original joints—is admitted by every maintenance man who has seen how these joints become coated with rust, occasionally fractured or distorted, or otherwise impaired by exposure to the elements and the strain of continuous service.

On many of the leading trunk line systems WHALL'S **Special Railroad** FIBRE is specified for ALL renewals because experience has proved its use results in

Longer Wear—Fewer Renewals—Lower Ultimate Costs

If you have not been using WHALL'S **Special Railroad** FIBRE, requisition a supply to try out, preferably where you have been having the most trouble. It costs no more to buy. Your supply department will obtain it, if you specify "WHALL'S" on your requisition and insist on getting it.

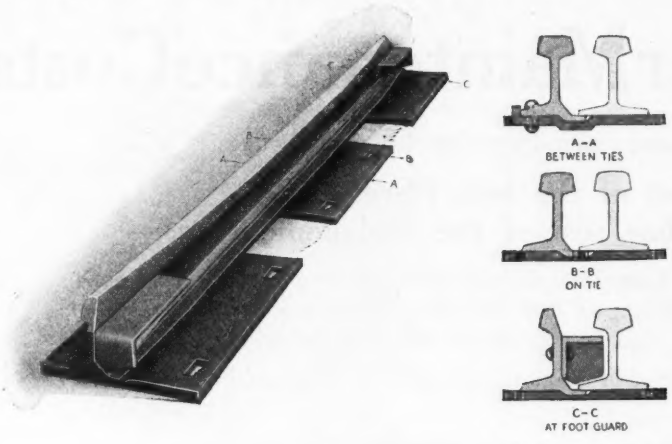
MANUFACTURED ONLY BY

C. H. WHALL COMPANY

Pioneer Manufacturers of HARD FIBRE for Rail Joint Insulation

170 SUMMER STREET **BOSTON, MASSACHUSETTS**

Bethlehem Rolled Steel One-Piece Guard Rail



The Rolled Steel One-Piece Guard Rail here illustrated is rolled with a depressed flange on one side which hooks under the base of the running rail its entire length, thus positively preventing overturning.

Three heavy two-tie base plates and the foot guards at each end are permanently attached, forming a complete unit ready for installation. No clamps, braces, tie plates, foot guards, filler blocks, or bolts are required.

Bethlehem Rolled Steel One-Piece Guard Rails are recommended for high speed main line as well as yard service. They are easily and quickly installed, can be adjusted for wear, and reduce maintenance charges to a minimum.

BETHLEHEM STEEL COMPANY, *General Offices:* BETHLEHEM, PA.

Sales Offices:

New York Boston Philadelphia Baltimore Washington Atlanta Pittsburgh Buffalo
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Bethlehem Steel Export Corporation, 25 Broadway, New York City, Sole Exporter of our Commercial Products

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WATER SERVICE

OUTDOOR
BUBBLE FONT
FOR
YARDS AND TERMINALS

Made for outdoor service. The only drinking fountain that will not freeze and burst. Operates day after day, year in and year out. Practically everlasting in life and performance.

The outcome of over 70 years of cumulative water service knowledge.

No digging up after once installed.

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Write for Booklet *"What an Outdoor Drinking Fountain Should Be"*

ALSO

Murdock Water Service Boxes for Coach Yards, Terminals, Cinder Pits. 12 Types.
"Genuine" Murdock Self-Closing Hydrants.
Heavy Duty Indoor Drinking Fountains.

THE MURDOCK MFG. & SUPPLY CO.
CINCINNATI, OHIO
MAKERS OF OUTDOOR WATER DEVICES SINCE 1853

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A TYPE FOR EVERY SERVICE

Bulletins on request.

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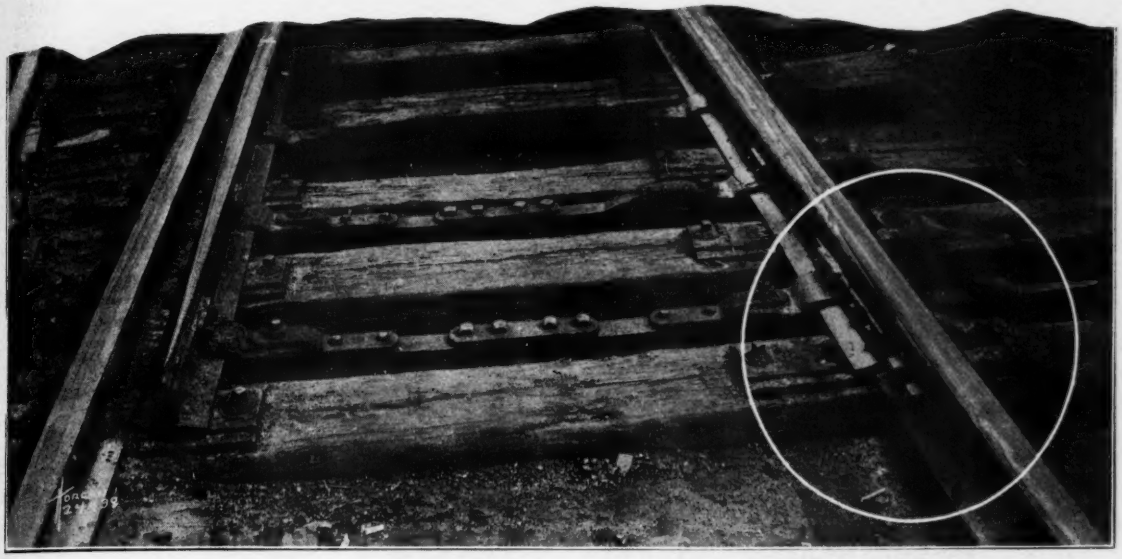

The "Mack" Switch Point Protector

Little But Mighty

The protector absorbs the shock—it arrests the impact of on-rushing tons—diverts by lateral thrust the flange grind that means short life to unprotected switch points.

"Mack Switch Point Protectors"—simple, inexpensive and positive in action, are to-day ***prolonging the life of switches*** on many roads. For switch points to last ten times longer with this protection is not uncommon in actual service test. "Mack Switch Point Protectors" are not only a valued maintenance accessory aiding in more economical operation, but act as a safety device by eliminating the possibilities of derailment at switches.

Installation can be made easily at small cost—replacements are made in a few minutes by one man—their efficiency is not impaired by weather conditions. Made of manganese steel—for any size rail.

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"Does the Work of an Army of Men"
SNOW PLOW ICE CUTTER DITCHER
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The Jordan Spreader is a year-'round machine. It spreads earth, digs ditches, shapes banks, cuts ice, fights snow.

"Right on the Job"

Have your vise stand and pipe bender right on the job—right where the work is being done. You can erect the Martin Portable Vise Stand anywhere in a moment. It will save you all the labor and wasted time of walking back and forth to a stationary vise stand.

THE MARTIN
Portable Vise Stand and Pipe Bender

stands rigidly without fastening. For cutting, bending and threading pipe and conduit it's the handiest tool yet devised. Write for price and full information.

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with a RIFE HYDRAULIC RAM without fuel, labor, freezing or repairs. A small stream operates the Rife Hydraulic Ram and fills water tanks. Easy to install. No attention required. Used by over fifty railroads, among which are:

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Manufactured in nine sizes up to and including 12 inch, the largest Ram which can be successfully used under all conditions.

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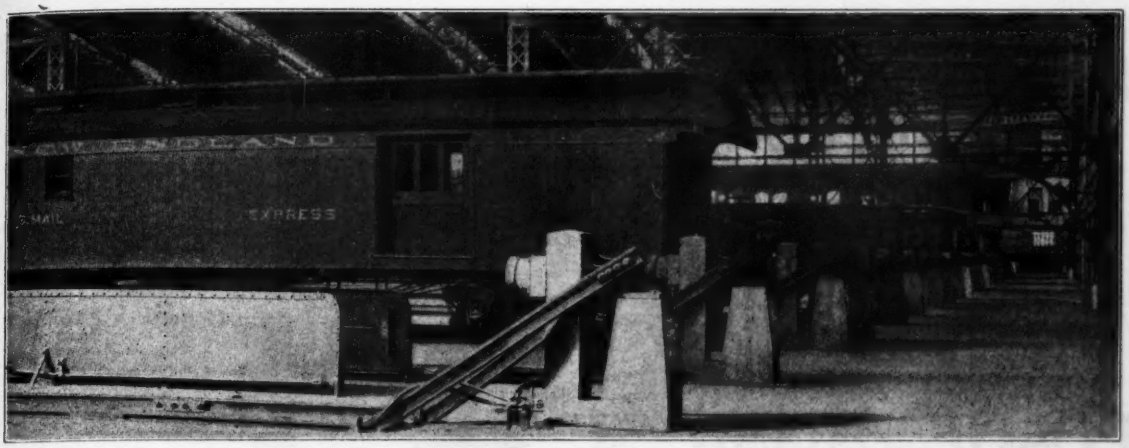

All Trains Stop Here!

Above is shown the installation of Ellis bumping posts in the South Terminal Station at Boston. No chances could be taken here of over-running the track ends, so the Ellis was the logical choice.

Below is the coach yard of the Baltimore & Ohio Chicago Terminal in Chicago, equipped with Durable passenger bumping posts, meeting every requirement of such a location.

These two types of bumping posts, produced by the oldest manufacturer of such equipment in the country, fill every need. Standardize on them, and specify for each installation (freight or passenger) the one which best suits the conditions.

Full information on request.

See our exhibit in Booths No. 219½-221
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MECHANICAL MANUFACTURING COMPANY

PERSHING ROAD AND LOOMIS STREET CHICAGO, ILLINOIS

How many of your water columns are knocked down every year?

What does the repairs and maintenance—not the result of ordinary use—cost you?

Avoid this annoyance, trouble and expense by using a

How lateral movement of spout prevents column being knocked down

The open telescopic joint does not waste a drop or water. It banishes the usual winter time troubles. Ice does not collect upon it.

The valve permits the maximum amount of water to flow in the shortest time. There is a minimum of frictional resistance. It shuts the water off quick without water hammer.

Try the Poage Style H column. You will find that it has remarkable operating advantages.

POAGE Style "H" WATER COLUMN with FENNER DROP SPOUT

The three foot lateral range in the Fenner spout and the steel riser in the Poage Style H save the water column from being knocked down by the shifting of the tender.

The tender has to leave the track to knock this column down.

The flexible spout makes it unnecessary to spot the tender accurately. You save time by quick adjustment.

The five foot up and down range enables the water column to fill a tender of any height.

Manufactured Exclusively By

The American Valve & Meter Co.

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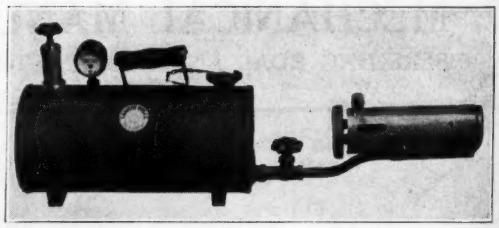
BOOTH 224

The V. G. Flood Light

5,000 C. P.—8 Hours

The Blake Manufacturing Co.

Mansfield, Pennsylvania



Every Interlocking Tower Should be Equipped With a Chausse Kerosene Torch

Over 3,000 Chausse torches are keeping switches, interlocking mechanism, terminals and isolated towers free from snow and ice. They are thawing frozen engines and pipes. Their great heat, lightness and dependability make them the standard on 50 railways. They are the only self-contained portable torches which burn entire fuel capacity in any position. Can not be extinguished by wind, rain or snow. They burn 3 hours without refilling and generate long clean flame. Safe, reliable and popular with crews.

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Chausse Oil Burner Company

Sole Manufacturer Under Improved Chausse Patents

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Subsidiaries - Chausse Mfg. Co., American Vapor Torch Co.

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Cut construction costs by using Massey precast concrete culverts and cattle passes. They cost less installed than other permanent structures.

Massey Concrete Products Corporation

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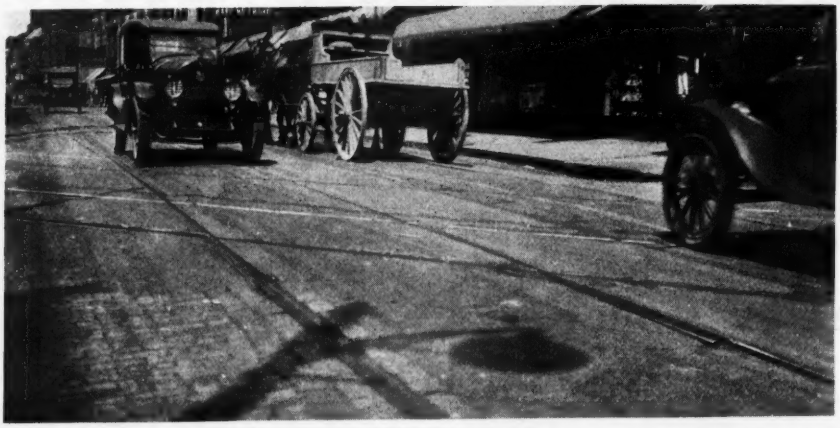

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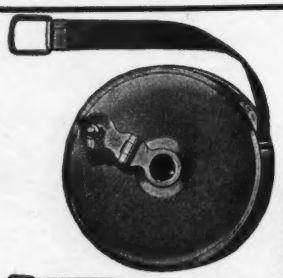
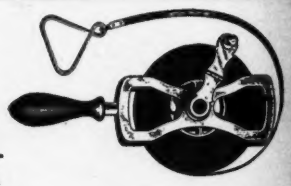


STURDY AND RELIABLE
LUFKIN TAPES



In Patterns Best for Every R. R. Requirement—Surveying—Engineering—Construction—M. of W. Steel Tapes with ***Instantaneous*** Readings and Nubian Finish. **Babbitt Chain** (Chicago Style) **Tapes** with ½ gage mark and improved pattern reels.

Among our popular woven lines are the **"Metallic,"** and the low priced tapes for all common uses, the **Ass Skin**, and the **Universal No. 733R Linen Corded** with **First Three Feet Reinforced.**

STOCKED BY RAILWAY SUPPLY AND HARDWARE HOUSES.

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Established 1881

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PLAIN FROGS, SWITCHES, CROSSINGS
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HIGH GRADE MANGANESE STEEL CASTINGS
FOR FROGS, SWITCHES AND CROSSINGS
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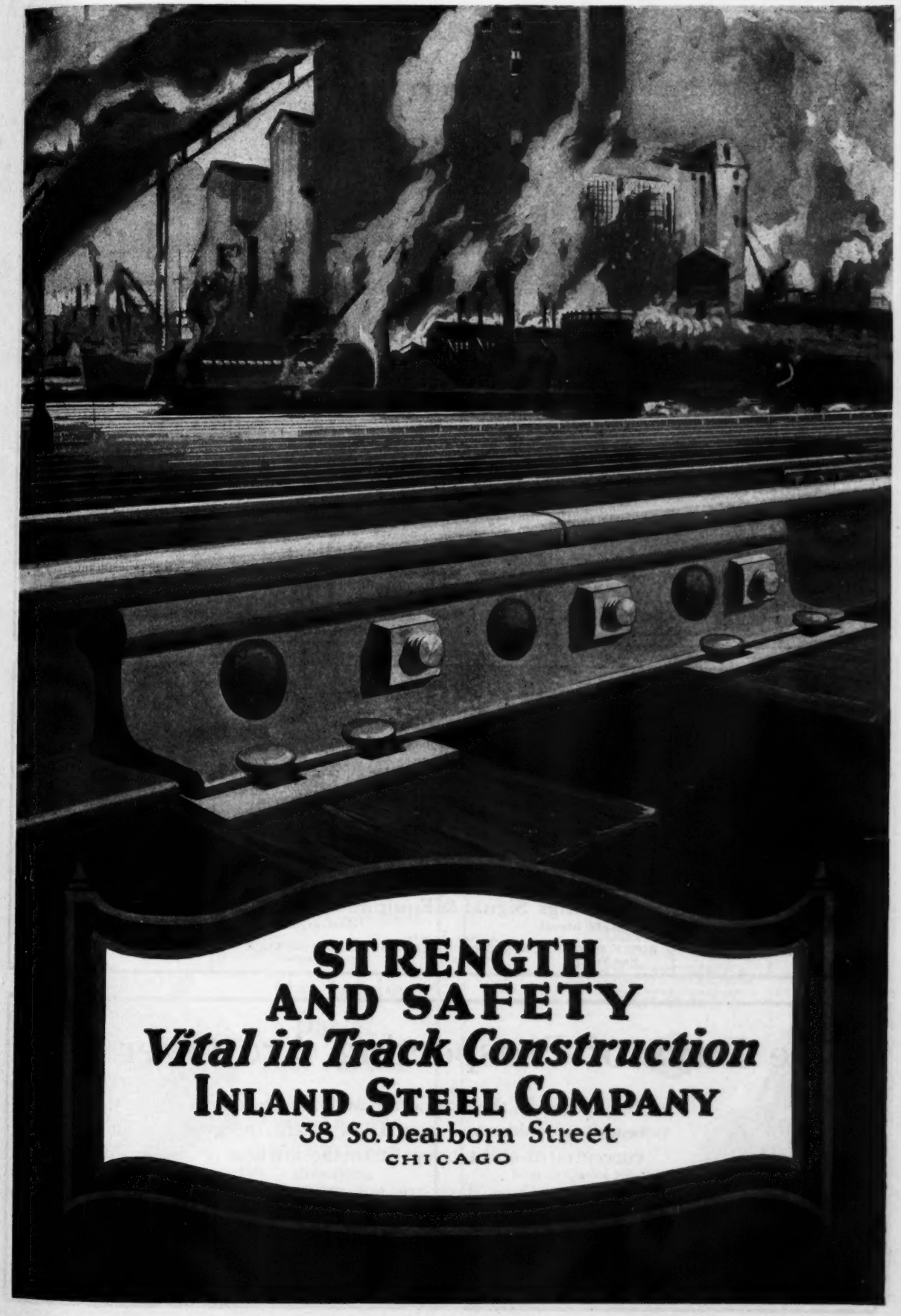
CEMENT MILL, MINING MACHINERY, ETC.
GRAY IRON CASTINGS


STRENGTH
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Vital in Track Construction
INLAND STEEL COMPANY
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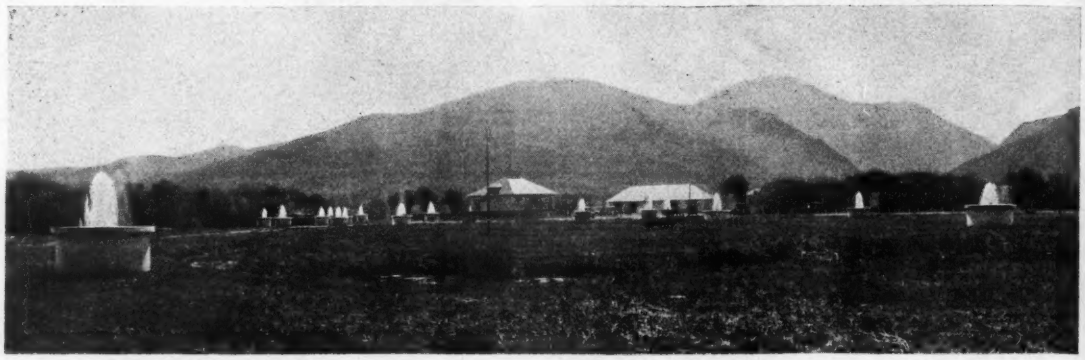

28 Wells Under Air Lift

At Ogden, Utah, 28 wells in Ogden Canyon are pumped by the Sullivan Air Lift. 17 of them are shown in this picture.

A central power plant of 5 Sullivan 14x10 motor-driven compressors furnishes air, and flexible control.

Careful development increased the natural flow from a possible 190 gal. per min. (per 6-inch well) to 500 gal. per min.

The story is in "Mine and Quarry" No. 1242. *Ask for a copy.*

A Sullivan Air Lift will pump your wells for locomotive supply economically, reliably, and is almost automatic. It will increase the flow from your present wells.

Ask for our new "Railroad" booklet, No. 1971-H.

SULLIVAN MACHINERY COMPANY

411 PEOPLES GAS BLDG. **CHICAGO, ILLINOIS**

HASCO METHOD

TELL-TALES On Bridge and Tunnel Warnings

Can now be taken down and replaced by one man from the ground.

No more need of sending a crew of 3 or 4 men over your road with a long ladder.

We can eliminate your entire labor costs and make your bridge and tunnel warnings 100% efficient.

SAFETY—ECONOMY
Efficiency—Standardization

Write for full information regarding
HASCO TELL-TALE HANGERS and REPLACERS

Hastings Signal & Equipment Co.
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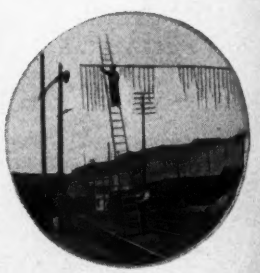


OLD METHOD

The Days of Prospecting Are Over

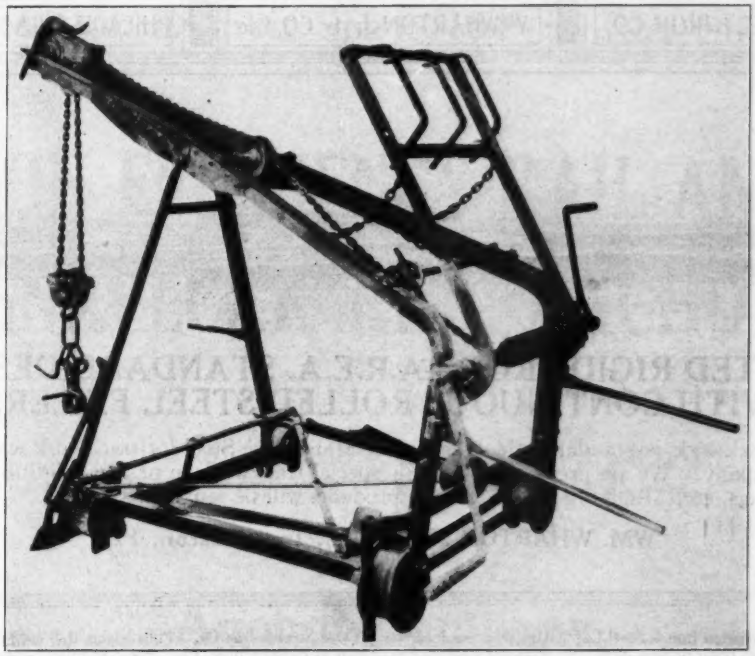
No longer do the prospector and the pack mule roam the hills in search of gold—wise men know where the gold lies and steady, concentrated effort brings it to the markets of the world.

Wise men these days are not prospecting for business and wise, buyers of railroad materials are watching the steady, consistent effort of the advertisers in

Railway Engineering and Maintenance

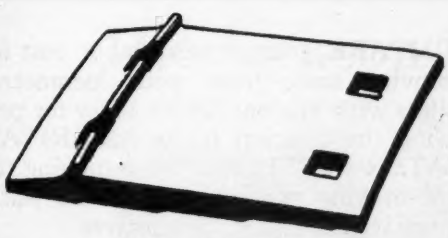
The THREE MAN RAIL LAYER has been IMPROVED

It now handles 130 lb. Rail—39 ft. long—with comparative ease



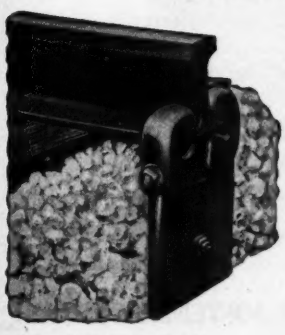
Why not replace your earlier model that has paid for itself many times, with a machine of the latest type?

For further information write to **MAINTENANCE EQUIPMENT CO., Railway Exchange, Chicago**



The Lundie Tie Plate

Will give rail and wheels longer life.
Will hold gauge and not injure a single fibre of the tie.
Will not rattle.



The Lundie Duplex Rail Anchor

Requires only one anchor per rail.

Will hold in both directions.

The Lundie Engineering Corporation

920 Broadway, New York

166 West Jackson Boulevard, Chicago

BLAW-KNOX BUCKETS ARE THE STANDARD in Construction Work, in Industrial Plants; in Railroading—WHEREVER CLAMSHELLS ARE USED.

of complete line—to satisfy any demand for rehandling or digging; to fit any crane or hoist—built by

Master Builders of CLAMSHELL BUCKETS

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Built to last with a minimum of expense for upkeep and repairs.

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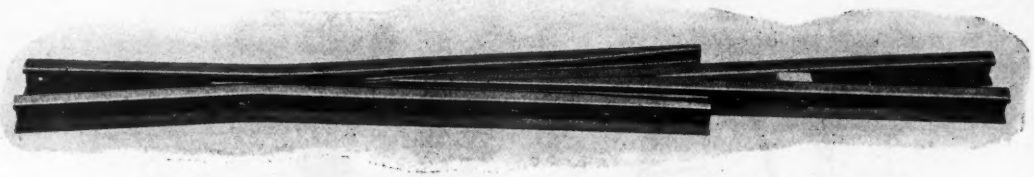
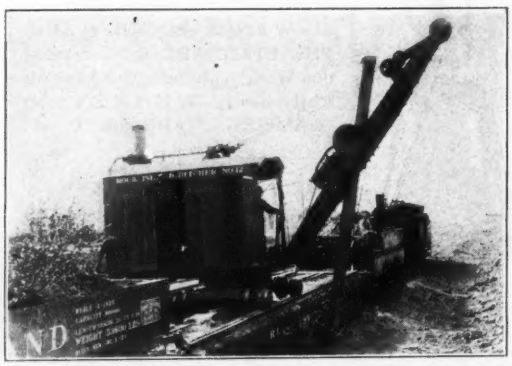


BOLTED RIGID FROG—A.R.E.A. STANDARD DESIGN WITH CONTINUOUS ROLLED STEEL FILLERS

Wharton trackwork is standard; the adoption of Manganese Steel for trackwork was originated by this company. We are prepared to furnish special trackwork to fit any condition; switches, frogs, crossings, etc. Bulletins covering these products will be sent upon request.

WM. WHARTON JR. & CO., Inc., Easton, Pa.

Taylor Wharton Iron & Steel Co.	Wm. Wharton Jr. & Co.	Tioga Steel & Iron Co.	Philadelphia Roll & Machine Co.
Plant at High Bridge, N. J.	Plant at Easton, Pa.	Plant at Philadelphia, Pa.	Plant at Philadelphia, Pa.
Manganese Steel Wearing Parts.	Special Trackwork. Cylinders for Gases.	Hammered and Pressed Forgings.	Rolls and Rolling Mill Machinery.



OSGOOD RAILROAD DITCHERS

Will increase the efficiency of your labor gangs and keep your right of way well drained and graded and at less cost than hand labor can do it.

Osgood Railroad Ditchers can be operated on flat cars, or on standard railroad wheels. They may also be mounted on continuous treads or traction wheels for use about the yard.

OSGOOD—A GOOD Labor Saver

The OSGOOD Company

MARION, OHIO, U. S. A.

COMPARE your present labor cost for removing scale from your locomotive boilers with the one hour's labor for preparing the solution for an AMERICAN WATER SOFTENER for removing the scale-making properties from the water before it goes to the locomotives.

HARD WATER CAUSES SCALE,

which means:

1. **Loss of fuel**
2. **Loss of mileage**
3. **Loss in efficiency**

It also means that locomotives must be kept in reserve to do the work while the cleaning and repairs made necessary by using hard water are in progress.

This is why more than twenty-five American Railroads use AMERICAN WATER SOFTENERS.

AMERICAN WATER SOFTENER COMPANY

Fairhill P. O. PHILADELPHIA, PA.

Specialists for more than twenty years in

Railroad Water Purification

See Our Exhibit Space 164½ N.R.A. Show

SNAPON EFFICIENCY RAIL ANCHOR
SNAPLOCK RAIL ANCHOR

Designed to combine low purchase price with low application and maintenance charges.

Railway Exchange
CHICAGO, ILL.

Anchor Company
756 Park Street, Milwaukee

Railway Exchange
ST. LOUIS, MO.

The Jackson Electric Tie Tamper

The problems incident to your ballasting program can, for the most part, be eliminated by the use of the Jackson Electric Tie Tamper.

Low cost, minimum operating and upkeep expense, simplicity of operation, together with a completed job pleasing to any railroader, compels the hearty approval of all those who number the Electric Tamper among their standard labor saving maintenance tools.

ELECTRIC TAMPER & EQUIPMENT CO.
RAILWAY EXCHANGE BUILDING
CHICAGO, ILL.

Are You Going to *Get* Your Share?

In 1923, the railroads spent over one billion dollars for improvements in their properties in addition to equally liberal expenditures for maintenance. Roughly speaking, two-thirds of the total expenditures went for equipment and one-third for roadway and structures.

During 1924, present prospects indicate that equally liberal expenditures will be made, but that these percentages will be revised to the extent that greatly increased expenditures will be made for additions and improvements to the track and structures.

THE REASON IS OBVIOUS

In 1923 the roads were confronted with what might easily have become an excess of traffic. Cars and motive power were the immediate necessity. Every dollar that could safely be so expended went for equipment. Construction and maintenance of way expenditures, while liberal were secondary to equipment. Many improvements waited.

In 1924 a very heavy traffic will still be within the present enlarged equipment capacity of the roads to handle it. But it must be handled within narrower limits of expense per ton mile and per train mile. This means a greater proportionate expenditure for maintenance of way and roadway betterment. "Reduce Operating Costs" is the slogan for 1924.

Traffic is now heavier than last year and though not so heavy during the first few weeks of the year the record of car loading is now better than ever before. This means increased wear and tear on roadway and track, increased expenditures to take care of wear and tear and increased earnings to take care of the expenditures.

A FEW PERTINENT FACTS

From budgets already prepared it is shown that one road is planning to expend $70,000,000 in improvements. Another has set aside $50,000,000, and two others have plans calling for $40,000,000 each; while the estimates of several roads call for expenditures of from $12,000,000 to $18,000,000. These are only a few of the larger items.

These plans include a large amount of second and other multiple track, the enlargement of terminal facilities, etc., which will require large tonnages of rails, joints, tie plates and other track accessories, as well as the tools and appliances for doing the work. Other improvements will require other materials and supplies in similar proportions.

This work comes within the field of

RAILWAY ENGINEERING AND MAINTENANCE

Its pages afford the medium through which to make known your products which will necessarily be in demand.

You cannot afford to miss the opportunity its advertising pages afford for engaging the attention of over 8,300 of the men who will authorize the supplies for this year's comprehensive program.

Ask us for further particulars

Railway Engineering and Maintenance

608 So. Dearborn St., Chicago

Are You Going to *Do* Your Share?

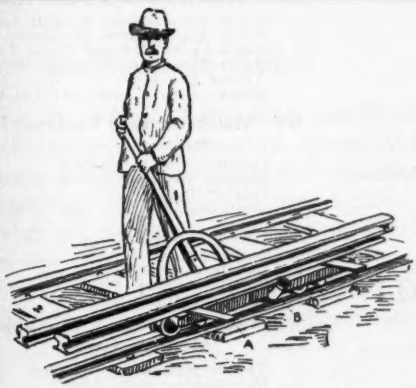
WE CAN END THIS FOR YOU

Fifteen largest railways in America are now using McWane Precalked Joined Cast Iron Pipe in small sizes to insure permanence in water and air lines. Being cast iron, McWane pipe is rust-proof and cinder-proof. Costs little to install and nothing to maintain. Sizes 1¼ inches up. To ignore McWane pipe is expensive.

Write today for booklet R, prices, names of users.

McWANE CAST IRON PIPE CO.

Birmingham, Alabama



EACH CAR A LABOR SAVER

Pony Car and Skid Set.

American Trackbarrow.

Pony Car Skid Set Ballast Box.

Carbarrow.

Dandy Car.

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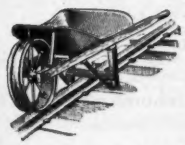

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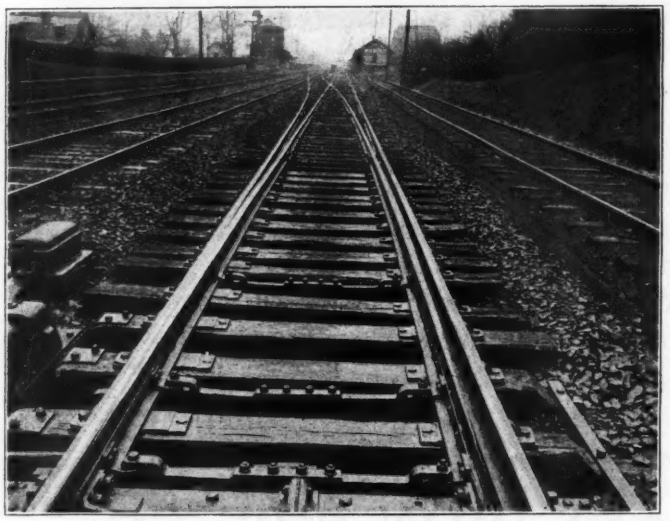

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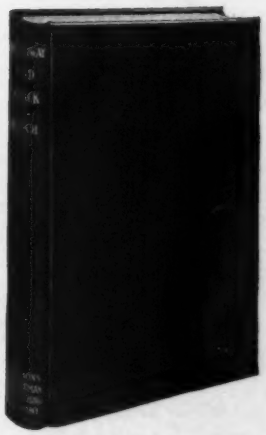

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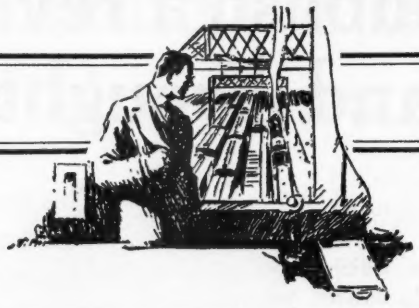

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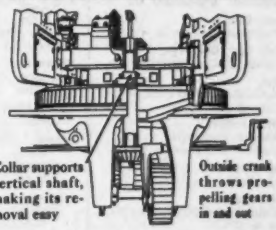

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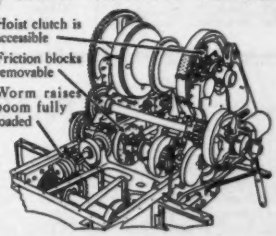

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Massey Concrete Prod. Corp.

Telltales.
Hastings Signal & Equipment Co.

Thawing Outfits.
Chausse Oil Burner Co.

Ties.
International Creosoting & Construction Co.
Long Bell Lumber Co.

Tie Plates.
Bethlehem Steel Company.
Inland Steel Co.
Lundie Engineering Corp.
Sellers Manufacturing Co.

Tie Plate Clamps.
Q & C Co.

Tie Rods.
Bethlehem Steel Company.

Tie Spacers.
Maintenance Equipment Co.

Tie Tampers.
Electric Tamper & Equipment Co.

Timber, Creosoted.
International Creosoting & Construction Co.
Long Bell Lumber Co.

Tine Plates.
Bethlehem Steel Company.

Tongue Switches.
Bethlehem Steel Company.

Tool Steel.
Bethlehem Steel Company.

Tools, Oxy-Acetylene Welding and Cutting.
Air Reduction Sales Co.

Tools, Wrecking.
Industrial Works.

Torches, Kerosene Blow.
Chausse Oil Burner Co.

Torches, Oxy-Acetylene Welding and Cutting.
Air Reduction Sales Co.

Track Barrow.
American Trackbarrow Co.

Track Drills.
Ingersoll-Rand Co.

Track Insulation.
Diamond State Fibre Co.
Q & C Co.

Track Jacks.
Idol Track Liner Company.
Verona Tool Works

Track Liner
Idol Track Liner Co.

Track Material.
Inland Steel Co.
Ramapo Ajax Corp.

Track, Portable.
Western Wheeled Scraper Co.

Track Scales
Fairbanks-Morse & Co.

Track Tools.
Q & C Co.
Verona Tool Works.

Transfer Tables.
Industrial Works.

Trestle Slabs.
Massey Concrete Prod. Corp.

Tunnel Warnings.
Hastings Signal & Equipment Co.

Vacuum Pumps.
Ingersoll-Rand Co.

Ventilators.
Q. & C. Co.

Vise Stands.
Martin & Sons, H. P.

Warning Devices—Bridge and Tunnel.
Hastings Signal & Equipment Co.

Washers.
Diamond State Fibre Co.

Water Cranes.
American Valve & Meter Co.
Fairbanks-Morse & Co.

Water Columns.
American Valve & Meter Co.
Fairbanks-Morse & Co.

Water Softening Plants.
American Water Softener Co.

Water Tanks.
Chicago Bridge & Iron Works.

Water Treating Tanks.
Chicago Bridge & Iron Works.

Weed Killer.
Bogle Co., R. H.
Chipman Chemical Engineering Co., Inc.
Reade Manufacturing Co.

Welding, Oxy-Acetylene.
Air Reduction Sales Co.

Wharf Cranes.
Industrial Works.

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Fairbanks-Morse & Co.

Fairmont Railway Motors, Inc.
Maintenance Equipment Co.
Mudge & Co.
Woolery Machine Co.

Wire.
Armco Culvert & Flume Mfrs. Assn.

Wood Grapples.
Industrial Works.

Wood Preservative
Bogle Co., R. H.
Chipman Chemical Engineering Co., Inc.
Long Bell Lumber Co.
Reade Manufacturing Co.
International Creosoting & Construction Co.

Wood Grapples.
Industrial Works.

Woodworking Machinery.
American Saw Mill Machinery Co.

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THE IDOL TRACK JACK AND TIE SPACER

Weighs only 26 pounds

With the Idol Track Jack and Tie Spacer one man can carry his whole outfit on his shoulder: Jack, Wrench, Pick and Shovel.

The Idol Track Jack and Tie Spacer has many uses, such as raising track and joints, spacing ties, pulling spread rail into place, in fact, anything that any track jack will do.

One man with such an outfit can make any ordinary repair along the line without assistance, thereby cutting down the track gangs to a minimum.

The Idol Track Jack and Tie Spacer is useful for bridge work as it can be operated in any position: upright, lying down or on a slanting angle.

The Idol Track Jack and Tie Spacer can be operated either up or down.

Idol Track Jack will be shown at the exhibit of the National Railway Appliance Association, Coliseum, Chicago, Ill., March 10th to 13th inclusive, Booth 225.

THE IDOL TRACK LINER COMPANY

434 South Wabash Avenue, CHICAGO

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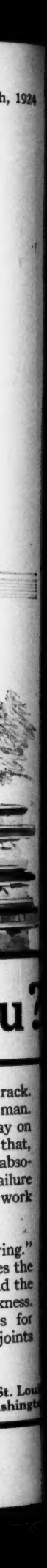
You'd hire him—wouldn't you?

The wrench in the big fellow's hands is the new Verona Ratchet Action Wrench which combines the convenience of a ratchet wrench with the strength of a standard track wrench.

SUPPOSE a husky young giant should apply for a job on your track. Suppose he had several times the strength of an ordinary man. Suppose he could do the work of two men, but do it better, stay on the job longer, and be free from fatigue and weakness. Suppose that, as a result of his super-human strength, you could rely upon him absolutely, not only to do his own work, but to compensate you for failure on the part of other men in his crew. Suppose he were willing to work for only slightly more than you pay an ordinary man.

You'd hire him—wouldn't you?

Well, he wants a job. His name is "Verona Rail Joint Spring." Compared to an ordinary nut-lock, he is a giant indeed. He does the work of two nutlocks, does it better, stays on the job even beyond the life of the rail, and is free from flattening, fatigue, and weakness. Because of his unparalleled reactive pressure, he compensates for stretched, rusted, and worn bolts. His business is to make joints tight and keep them tight. He performs this task unfailingly.

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San Francisco, New Orleans, Montreal, Washington